An intervention to promote Healthy Eating and Physical Activity in Lebanese School children: Health-E-PALS a pilot cluster randomised controlled trial

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An intervention to promote Healthy Eating and Physical Activity in Lebanese School children:

Health-E-PALS a pilot cluster randomised controlled trial

Submitted by

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Abstract: An intervention to promote Healthy Eating and Physical Activity in Lebanese School children: Health-E-PALS a pilot cluster randomised controlled trial

Aim and objectives: The purpose of this study was to develop, implement and evaluate the effectiveness of a multicomponent school-based intervention that focused on promoting healthy eating and physical activity with school children (aged 9 to 11 years) in Lebanon, in order to prevent childhood obesity.

Methods: A school-based intervention adapted to the culture of Lebanese and Arab populations and based on the constructs of the Social Cognitive Theory was developed. The intervention consisted of three components: classroom curriculum, food service, family involvement. Eight schools were selected from two different communities (high and low socioeconomic status) in Beirut and were randomly assigned (by a toss of a coin) to either the intervention or control group. Students aged nine to eleven years in intervention schools were exposed to the intervention components for three months. Students in control schools received their usual school curriculum. Anthropometric measurements, questionnaires on determinants of behavioural change, eating and physical activity habits were completed by the students in both groups at baseline and post intervention. Focus group interviews were conducted with students, teachers and parents in intervention schools at the end of the study.

Results: Changes were observed based on self-report measures. Daily breakfast intake increased significantly in the intervention group compared with the control group (3.5 times more $p<0.001$). Students in the intervention group reported consuming significantly less chips and sweetened drinks at post-test compared with controls (86% & 88% less respectively $p<0.001$). There was no difference in physical activity and screen time habits and no changes in BMI between groups at post intervention. Knowledge and self-efficacy scores increased for the intervention (+2.8 & 1.7 points respectively $p<0.001$) but not for the control group. Interview data from focus groups showed that the programme was generally well accepted; students benefited in a pleasurable way and made attempts to change their eating and physical activity habits. Limitations for better outcomes include the length of the programme and the school environment.

Conclusion: "Health-E-PALS" (Healthy Eating and Physical Activity in Lebanese School children) is a promising innovative, theory-based, culturally sensitive intervention to promote Healthy Eating and Physical Activity in Lebanese school children with a regional perspective.

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Contribution to the PhD work

I hereby assert that the work in this thesis is my own. Below, the following summarizes the main phases of my work including the areas where I received contribution from others.

Programme development: In this first phase of my PhD programme, I developed all concepts and components of the programme; educational material and content. Rowan Alayili (student graphic designer) designed and illustrated the educational material. I pilot tested myself the material and activities on a group of students prior to the start of the intervention. I organised and conducted parents' and school administrators meetings.

Data collection: I personally conducted all aspects of data collection at baseline and at post-intervention, both for quantitative and qualitative data with the help of Hiba Houri (research assistant). I also implemented the intervention components in all schools, with all students included in the programme.

Data analysis and interpretation: During this phase I performed all the statistical analysis and interpretation of quantitative and qualitative data described in this thesis, with the help of Hiba Houri (research assistant) for data entry, and guidance from Dr Lilian Ghandour and Dr Adetayo Kassim on appropriate statistical tests and the use of STATA.

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Training and publications during the PhD programme

<u>Training and development</u>

Courses:

- Qualitative Health Research (HBED 334). Faculty of Health Sciences, American University of Beirut. Spring 2009-2010.

- SPSS tutorials prepared for " Biostatistics in Medicine" (EPHD 325). Faculty of Medicine, American University of Beirut. Spring 2009-2010.

Conferences:

- Ministry of Health, United Arab Emirates: 11th annual Woman's conference: *Healthy food and physical activity, today's challenges.* Abu dhabi, February 2012.

- XI International Congress on Obesity ICO 2010, Stockholm, July 11-15

- The Lebanese Academy for Nutrition and Dietetics: *Current Challenges in Adolescent and Child Nutrition Conference,* Beirut, Lebanon, October 2009.

- The First International Conference and Workshop on Childhood and Adolescent Obesity: *Research, Prevention and Intervention*. Riad, Kingdom of Saudi Arabia. March 2009

- The American Dietetic Association. "Food and Nutrition conference and Expo". Philadelphia, USA, September-October 2007.

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Chapter one: Introduction

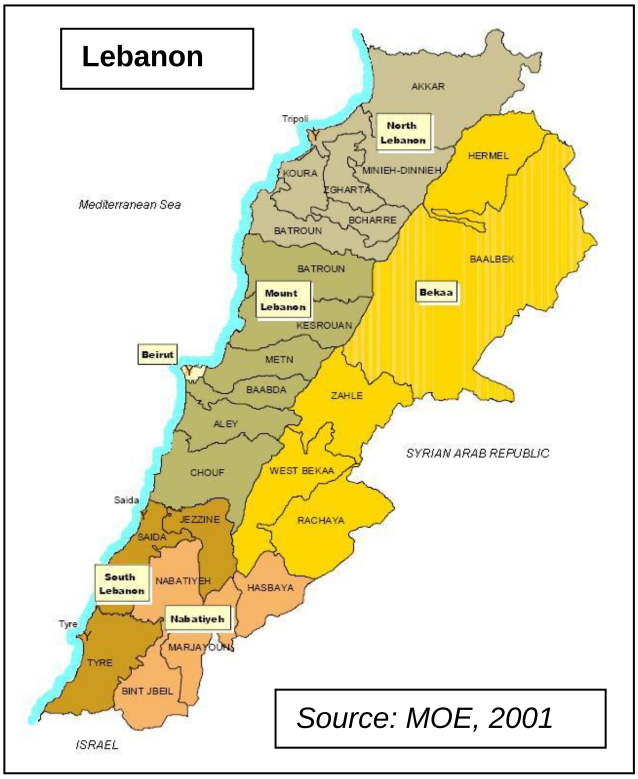
1.1 Background

Lebanon is a small middle-income country in the Middle-East situated on the Mediterranean coast. Lebanon is characterised by a high urbanisation rate (81%), a high literacy rate (85%) and life expectancy close to 72 years *(United Nations system Lebanon, report 2007/8).* Lebanon's demographic structure is very complex and represents a model for diversity in the Middle East region. The population is divided into two main religions: Christian and Muslim. These two main religions are further divided into seventeen different sects that include: Catholic, Orthodox, Shiite, Sunni and Druze.

Over the last three decades, Lebanon has experienced a nutrition transition resulting in a shift towards a diet high in energy-dense food and sedentary lifestyle.

This epidemiological transition is mostly due to the increase in westernization and urbanization that has been taking place over the past decades (*Food Agriculture Organisation, 2007).* Figure 1.1 shows Lebanon's map detailing the nation's location and borders.

Figure 1.1 The map of Lebanon



Source: MOE, 2001

Although life expectancy and overall health have improved because of the advancement in nutrition, hygiene and infectious diseases control, there has been an important shift in disease and morbidity profile from primarily infectious to non-communicable diseases such as cardiovascular diseases (CVD) and cancer *(Sibai et al, 2010).*

In 2001, Sibai et al. found CVD and cancer to be the leading causes of death in Lebanon and that mortality rates from CVD showed a similar pattern to industrialized countries such as the United States and England.

The results from a national population based study in Lebanon showed high prevalence rates of overweight and obesity similar with those observed in developed countries, both in adults and children *(Sibai et al, 2003).* Recently, a study on the secular trends in the prevalence of overweight and obesity in Lebanon over a 12 year period found an alarming increase in obesity prevalence in the Lebanese population *(Nasreddine et al, 2012c)*. Furthermore, a new study established that the alarming increase in obesity trends in Lebanon was paralleled by an escalation in the prevalence of hypertension, diabetes and hyperlipidaemia *(Nasreddine et al, in press).*

Information on food consumption in Lebanon is scant, specifically, research targeting children and adolescents. There are only a few nutritional studies at the national level. The information on dietary habits and how they relate to health were a result of targeted research that is sample specific. Information about current food choices and eating patterns of Lebanese school age children that are referenced *(Akl, 2012; Nasreddine et al, 2012a; Chakar & Salameh, 2011; WHO, 2005; WHO, 2011)* show that Lebanese students suffer from poor eating habits. One of these studies is the World Health Organization Global School base Student Health Survey (GSHS), a project developed in 2001 in collaboration with UNAIDS, UNICEF and with technical assistance from the United Centres for Disease Control and Prevention. The GSHS is a school based survey conducted among students aged 12-15 years and measures the behaviours and protective factors associated with the leading causes of mortality and morbidity among youth. The survey covers data on many health practices amongst which are dietary behaviours. Results from the GSHS *(WHO, 2005; WHO, 2011)* implemented in 2005 and 2011 in Lebanon, show that only one in four students consumed the recommended five portions of fruits and vegetables a day and the trend in fruits and vegetable consumption decreased as the students got older. Fast foods and soft drinks consumption was found to be relatively high. About a fourth of students reported eating or ordering a meal from a fast food restaurant three or more times a week; over thirty per cent of students consumed carbonated soft drinks two or more times a day. In addition, researchers found that certain meal patterns as well as consumption of high energy dense foods were associated with increased BMI in children *(Akl, 2012; Nasreddine et al, 2012a; Chakar & Salameh, 2011).*

The authors concluded that the Lebanese Integrated Health Curriculum needs to be reassessed, and a comprehensive school health programme must be adopted *(WHO, 2005).* Multicomponent interventions, policies and nutritional strategies to promote weight control and physical activity nation-wide were recommended to curb the childhood obesity crisis in Lebanon *(Sibai et al, 2003; Hwalla et al, 2005; Nasreddine et al, 2012a).*

Reviews have shown that effective intervention strategies to prevent and reduce childhood obesity included school-based interventions targeting a variety of energy balance health behaviours *(Waters et al, 2011; Shaya et al, 2008).* In order to achieve this, carefully planned, theory-based multidisciplinary approaches were essential *(Sharma, 2007).*

Preventive measures should start early in life and students aged 9-11 years are an important group to target for promoting healthy behaviours being in the transition from childhood to adolescence. Schools are considered an important environment to promote energy balance health behaviours in children and family support is of particular importance to assist in these behaviours *(Brug et al, 2010).*

In Lebanon, school-based interventions to promote healthy eating and encourage physical activity are lacking. The Lebanese integrated health curriculum incorporates nutrition education into taught material in elementary school, grades four and five (student aged 9-11years). This includes one chapter covering basic information about food groups and classes of nutrients, in “the life sciences and biology” course.

The obesity epidemic and its impact on the young generation in Lebanon, coupled with the lack of effective school-based interventions were instrumental to establish the need for a new focused project in this field. The present research explores the feasibility of a pilot exploratory intervention the Health-E-PALS project: an intervention to promote **Health**y **E**ating and **P**hysical **A**ctivity in **L**ebanese **S**chool children and build on the previous work completed in Lebanon and in other countries.

1.2 Aim and objectives

The overall purpose of the research was to develop a theory and evidence-based multicomponent school intervention to prevent weight gain in school-aged children. The research focused on promoting energy balance health behaviours through focusing on increasing nutrition awareness and physical activity with children aged 9-11 years. The study also aimed at implementing and evaluating the effectiveness of the intervention in selected primary Lebanese schools of different socioeconomic status.

The specific objectives of the research were:

1. Develop a school-based multicomponent intervention that is theory and evidence-based and culturally favourable, focusing on: food consumption, physical activity, sedentary behaviours.

2. Involve the parents and the school environment in the programme.
3. Implement the intervention in four primary Lebanese schools.
4. Test and evaluate the feasibility and effectiveness of the intervention on healthy energy balance-related behaviours such as physical activity and dietary behaviour change, as well as determinants of these behaviours (such as knowledge and self-efficacy) in school children.

To reach these objectives, the study will be guided by the Medical Research Council framework for the development and evaluation of randomised controlled trials. The general impact of the research will be disseminated and translated for practice and policy, and inform the development of school policies to prevent and decrease childhood obesity and its related co-morbidities in Lebanon and the region. The components of this intervention will be tailored according to specific Lebanese and Arabic culture and traditions, and will lead to the development of an educational kit that can be used in schools at the regional and national level.

Chapter two: Literature review

This chapter describes the prevalence of childhood obesity globally, and particularly in the Eastern Mediterranean region and Lebanon. The health and psychosocial consequences of childhood obesity are also explained. The chapter as well covers the nutrition transition that is taking place in the current developing world and is considered the major origin of the obesity epidemic. Then, intervention strategies to prevent and reduce childhood obesity are reviewed focusing on school-based interventions targeting 9-11 year old children as this is the aim of this thesis. The chapter also includes sections reviewing major health behaviour theories and approaches in order to identify successful intervention schemes and strategies to be addressed while developing the Health-E-PALS programme.

The literature review for the present thesis was conducted through an online data base search and a close review of the Lebanese Ministry of Education records and studies. The online database was led to identify the prevalence of childhood obesity globally and in the Middle Eastern Region using key words in Medline, PubMed, Google Scholar and the WHO databases. Determinants of childhood obesity were then reviewed as well as interventions to prevent childhood obesity and these were identified from key review papers. A further search was done using the reference lists of key review papers to identify relevant and suitable studies and strategies used in interventions targeting childhood obesity prevention.

Criteria considered during articles search: publication in English language, focus on children and adolescents, school as the study site. Key terms used for electronic searches included: childhood obesity epidemic, Eastern Mediterranean Region, nutrition transition, school-based nutrition interventions, behavioural theories, 9-11 year old children.

Records at the Ministry of Education helped identify and select the target student group and schools. Best-practice and evidence-based research was identified from the literature and was used as a skeleton to develop the current study.

2.1 Childhood Obesity

According to the World Health Organization, worldwide obesity has more than doubled since 1980 and childhood obesity prevalence has increased at disturbing pace. It was estimated that nearly 43 million children under age 5 were overweight in 2010.

2.1.1 Global prevalence of childhood obesity

Overweight and obesity are serious public health problems and excess body weight poses one of the most difficult challenges of the 21st century for many health agencies. In 2008, an estimated 1.46 billion adults worldwide had a Body Mass Index (BMI) of 25 or greater. Of these, 205 million men and 297 million women were obese *(Finucane et al, 2011).*

The International Obesity Task force reports prepared for the WHO Global Burden of Disease Project suggest that the mean body weight in most populations will continue to rise, and by 2030 half of the entire adult population, in many countries could be obese *(James et al, 2004a).*

The trend in obesity is especially alarming in children and adolescents. The increase in the prevalence of childhood obesity has been growing steadily; the current rate is ten times that in the 1970s *(WHO, 2007).* In 2006, the International Obesity Task Force (IOTF) stated that ten per cent of the world’s children are overweight or obese *(James et al, 2006).*The problem is global and gradually touching many low and middle-income countries, mainly in urban locations *(WHO, 2007).* Childhood obesity and overweight increased more intensely in economically developed countries and in urbanised populations.

Data reporting international childhood obesity rates varies. The use of different criteria for defining childhood obesity among countries and researchers constitutes one of the main factors limiting the understanding of the global circumstances of childhood and adolescent obesity *(Wang and Lobstein, 2006).* On the other hand, the lack of comparable representative data from different countries represents another hindrance when studying the global secular trends of obesity in the younger population.

At present, there are no broadly approved standards for classifying overweight and obesity in children and adolescents *(Lobstein et al, 2004).* Thus, results can vary considerably when using different references. Although the word “overweight” may imply a minor degree of excess fat than does the word “obesity”, no global agreement criteria exist to make this distinction. The terms are generally used alternatively in the literature *(Barlow and Dietz, 1998).* Formerly, researchers adopted the weight-for-height index to classify obesity, especially for children under the age of 10 years. In recent years, mainly since the 1990s, Body mass Index (BMI) has been accepted as a valid and simple method to measure obesity in children *(Dietz and Bellizzi, 1999).* In addition, compared with the weight-for-height index, the BMI takes into account the age of the child.

A number of age- and gender-specific cut-off points have been developed to classify obesity and overweight in children. Several countries such as the United States, the United Kingdom and France established different BMI standards for children *(Kuczmarski et al, 2000; Cole et al, 1995; Rolland-Cachera et al, 1991).*

Currently there are two international references used, the WHO and the International Obesity Task Force (IOTF) references. The CDC growth charts are also widely used. When comparing WHO references and CDC charts for BMI-for-age, important differences are noticed *(De Onis et al, 2007a)*. The WHO BMI-for age standard for the under 5 years, over estimates overweight and underrates under nutrition. This is possibly due to differences in study design and sample characteristics between WHO standards and CDC charts. WHO standards are based on data collected from a population-based study (including Brazil, Ghana, India, Norway, Oman and the United States); and the CDC charts are based on a national sample of US children. For school-aged children and adolescents, the reference data for BMI-for age recommended by the National Centre for Health Statistics (NCHS)/WHO only begins at 9 years of age and covers a restricted distribution range (5^{th}-95^{th} percentiles). The 2007 BMI-for age curves which updated the NCHS/WHO (1995), match WHO under-five curves perfectly, and are equivalent to the overweight cut-off points used for adults *(De Onis et al, 2007b).* Cut-off points for overweight and obesity in children were obtained by linking the data to the International Obesity Task Force (IOTF) cut-off points for adults (BMI of 25 kg/m^2 for overweight and 30 kg/m^2 for obesity).The WHO, after reviewing data sets from several populations, found that the NCHS data set was the most suitable for a smooth transition with the 2006 WHO child growth standard curves at 5 years with a good alignment with the IOTF cut-off values at 18 years. Consequently, the WHO reconstructed the 1977 NCHS/WHO reference using advanced statistical analysis.

Since there is no universal consensus on a cut-off point for defining overweight or obesity in children and adolescents, each country is using the reference standards that would mostly suit its population, although the 2007 WHO growth reference is recommended for international use *(De Onis et al, 2007b).* Table 2.1 shows the different cut-off points for childhood obesity and overweight depending on the reference criteria used and according to BMI.

Table 2.1: Criteria to define childhood overweight and obesity according to BMI

	BMI Classification	
	Overweight	**Obesity**
WHO, 2007[1]	Z scores ≥ 1 (sex and age-specific)	Z scores ≥ 2 (sex and age- specific)
WHO, 1995[2]	≥ 85th percentile (sex and age-specific) derived from the U.S. NHANES I	≥ 95th percentile (sex and age-specific) derived from the U.S. NHANES I
CDC, 2000[3]	≥ 85th percentile (sex and age-specific)	≥ 95th percentile (sex and age- specific)
IOTF[4]	≥ age- & sex-based cut-offs that correspond to a BMI of 25kg/m^2 at 18 yrs of age	≥ age- & sex-based cut-offs that correspond to a BMI of 30kg/m^2 at 18 yrs of age

[1]*De Onis et al., 2007b;* [2]*WHO, 1995;* [3] *CDC, 2000 ;* [4]*Cole et al., 2000*

Studies have shown that for all classifications, prevalence of obesity and overweight increased for all countries for which data was available *(Wang and Lobstein, 2006).*
Eneli and Dele Davies reported that in 77% of the countries analysed, the prevalence rate for children who were overweight was at least 10% *(Eneli and Dele Davis, 2008)*.
The prevalence of childhood obesity was found to be highest in the United States of America, the Middle East, and some European countries and lower in Africa and certain parts of Asia *(Low et al, 2009)*.

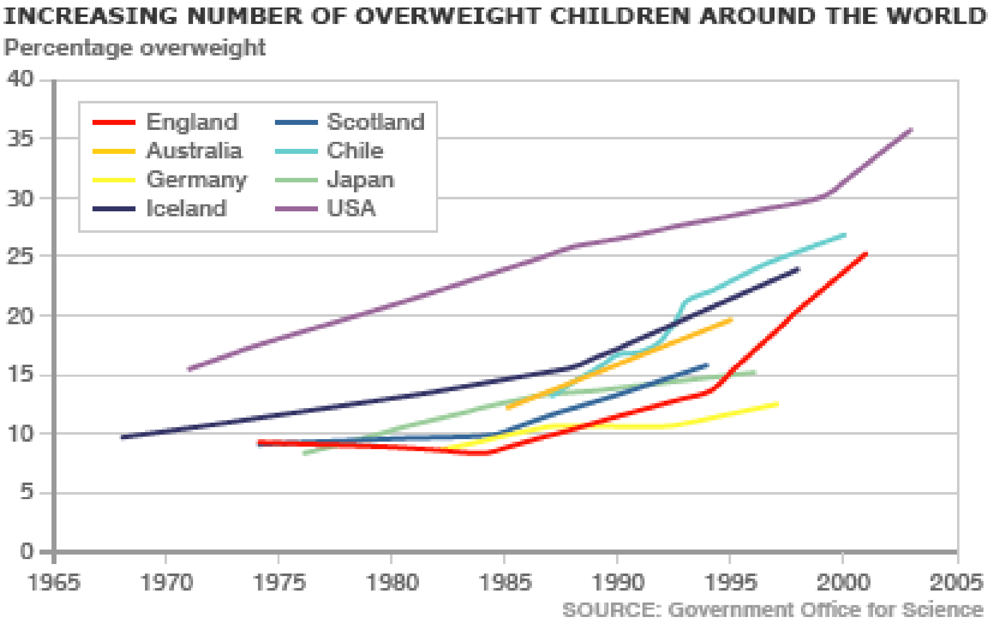
In the United States of America the most recent national surveys demonstrated that 21-24% of American children and adolescents were overweight and that another 16-18% was obese. A 2012 study noted a 16.9% prevalence of obesity in children and adolescents in 2009-2010, which is comparable to the prevalence rates reported in 2007-2008 *(Ogden et al, 2012)*. These findings indicate that the prevalence of overweight (BMI ≥ 85th percentile) children and adolescents in the US has increased by 50-60% in a single generation, and the prevalence of obesity has doubled. The prevalence of obesity in American Indians, Hawaiians, Hispanics, and blacks is 10-40% higher than in whites.

In Australia the prevalence of obesity has increased extremely in children over the past few decades. According to the Australian Institute of Health and Welfare 31.3% of children aged 7-15 years were overweight in 1995 compared to 19.9% children in 1985. Likewise, 10.2% of children were obese in 1995 compared to 2.6% in 1985 *(Australian Institute of Health and Wealth, 2004).*

The prevalence of overweight was especially alarming in Europe. Among children of primary school age (both genders), the highest prevalence of overweight was found in Spain (6–9 years, 35.2%) and Portugal (7–9 years, 31.5%) *(WHO, 2007)*; the lowest prevalence was found in Slovakia (7–9 years, 15.2%), France (7–9 years, 18.1%), Switzerland (6–9 years, 18.3%) and Iceland (9 years, 18.5%). The Pro Children study showed that more boys than girls were overweight. Prevalence was highest in Portugal, Spain and Austria and lowest in Belgium, the Netherlands and Denmark *(WHO, 2007)*.

Figure 2.1 shows the prevalence of overweight in children between 1967 and 2005 for selected countries.

<u>Figure 2.1:</u> Prevalence of childhood overweight in selected countries in the world (1967-2005)



A study on the time trends in childhood and adolescent obesity in England showed that there has been a noticeable increase in the prevalence of obesity between 1995 and 2005, followed by a tendency of level off or decrease to 2007 *(Stamatakis et al, 2010).* Similar stabilising trends in overweight and obesity have been reported in other European countries such as France *(Peneau et al, 2008; Lioret et al, 2009)*, Switzerland *(Olds et al, 2011)*, and Sweden *(Sjoberg, 2008*) as well as in the US *(Ogden et al, 2012)*.

It seems that, at least in the developed countries, the obesity epidemic may be slowing down after a sharp increase between the years 1967 and 2005 (Figure 1.1). The stabilisation of the childhood obesity trends may be due to the considerable media attention that obesity issues have received lately *(Department of Health, 2007)*, and to national anti-obesity policies and strategic targets *(Hercberg et al, 2008).*

Obesity is no longer restricted to developed countries; increased prevalence of childhood obesity was also seen in developing countries *(Gupta et al, 2012).* Obesity in children and adolescents aged 5 to 19 years was 41.8% in Mexico, 22.1% in Brazil, 22% in India and 19.3% in Argentina. Moreover, trends indicated an increasing prevalence in those countries: rates increased from 4.1% to 13.9% in Brazil between 1974 and 1997, from 12.2 to 15.6% in Thailand during 1991-1993, and from 9.8% to 11.7% in India from 2006 to 2009 *(Gupta et al, 2012).*

Contrary to developed countries, high socioeconomic status and residence in metropolitan cities were among important determinants for childhood obesity in developing countries. Poor physical activity facilities and female gender were also among determinants of obesity in youth.

2.1.2 Prevalence of childhood obesity in the Eastern Mediterranean Region

The Eastern Mediterranean Region (EMR) refers to all Arab countries excluding Algeria, in addition to Afghanistan, Iran and Pakistan. Available data suggests that the Middle East and the Arabian Peninsula regions are not exempt from the obesity epidemic that has reached worrying levels both among adults and children *(Musaiger, 2011)*. Prevalence of overweight and obesity among school children and adolescents is alarming in most countries of the region.

According to Kosti and Panagiotakos (*2006),* childhood overweight and obesity in the EMR is second to the United States of America and exceeds European countries.

It is worthwhile noting that there are many published data on the prevalence of overweight and obesity among children and adolescents in the region, however, not all were nationally representative and the definitions of obesity varied from study to another even in the same country *(Musaiger, 2011).*

A number of surveys have reported high prevalence of overweight and obesity in Saudi Arabia *(Madani, 2000; Al-Rukban, 2003; El-Hazmy & Warsy, 2002),* the United Arab Emirates *(Al-Haddad et al, 2000)*, Kuwait and Bahrein *(Al-Mahroos& Al-Roomi, 1999)*; an affluent society where obesity is becoming one of the most important health problems. The prevalence of overweight ranged from 5.4% in Iran to 32% in Kuwait, and the prevalence of obesity ranged from 1.6% in Iran to 14.9% in Kuwait. Table 2.2 shows national prevalence of overweight and obesity among school children and adolescents in selected EMR countries. In general overweight was more prevalent than obesity in both genders. However, prevalence of overweight and obesity by gender differed between countries (Table 2.2).

Moreover, trends in obesity prevalence are progressing at a dangerous pace in the region. According to a recent survey conducted in 2006 on children in the Eastern province of Saudi Arabia *(Al- Dossari et al, 2010)*, the overall prevalence of obesity was 23.3% compared with 15.6% in 1996 *(Al-Nuaim et al, 1996).* More than 50% of children between 14 and 18 years had a body weight above the 85th percentile.

Urgent actions are required to combat the growing problem of childhood obesity that has reached epidemic proportions in all countries of the EMR *(Musaiger, 2011).*

<u>Table 2.2:</u> Prevalence of overweight and obesity in selected EMR countries

Country	Study Criteria	Gender	Age(years)	Overweight (%)	Obesity (%)
Bahrain *(Bader et al, 2008)*	NHANES	M	15-18	15.8	13.7
		F	15-18	17.4	19.4
(Gharib and Rasheed, 2008)	IOTF	M	10-18	22.7	12.7
		F	10-18	29.4	13.1
Egypt *(National Nutrition Institute, 2008)*	CDC	M	10-18	11.5	6.5
		F	10-18	15.2	7.7
Iran *(Kelishadi et al, 2008)*	IOTF	M	6-18	5.4	1.6
		F	6-18	5.9	1.3
(Mohammadpour-Ahranjani, 2004)	CDC	M	11-16	18.8	7.3
		F	11-16	23.1	8.3
Kuwait (El-Bayoumi et al, 2009)	IOTF	M	10-14	29.3	14.9
		F	10-14	32.1	14.2
Lebanon *(Nasreddine et al, 2012c)*	WHO *2007*	M	6-9	17.2	19.5
		F	6-9	23.9	12.8
		M	10-19	23.8	14.9
		F	10-19	19.2	6.2
Syria *(Nasreddine et al, 2009)*	IOTF	M	15-18	22.1	15.1
		F	15-18	20.7	7.1
Qatar *(Bener & Kamal, 2005)*	IOTF	M	6-9	16.3	3.5
		M	10-18	27.5	7.1
		F	6-9	15.5	2.8
		F	10-18	20.0	3.9
Saudi Arabia *(El-Mouzan et al, 2010)*	WHO	M	5-12	19.9	7.8
		F	5-12	19.2	11.0
		M	13-18	24.8	13.8
		F	13-18	28.8	12.1
Tunisia *(Aounallah-Shikri et al., 2008)*	IOTF	M	15-19	17.4	4.1
		F	15-19	20.4	4.4
United Arab Emirates *(Malik & Bakir, 2006a)*	IOTF	M	14-17	32.3	13.3
		F	14-17	34.5	17.6

2.1.3 Prevalence of childhood obesity in Lebanon

The findings from the first study reporting on overweight and obesity trends in Lebanon from two national cross-sectional surveys conducted in 1997 and 2009, showed a rapid increase in BMI across sex and age groups *(Nasreddine et al, 2012c)*. Results indicated a statistical increase in obesity risk among children and adolescents as compared to 1997, particularly among 6-19 year olds. Overall, obesity rates were almost double in boys as compared with girls in both the 1997 survey and the 2009 study. While the prevalence of overweight was stable between 1997 and 2009, obesity was found to increase significantly during this age period (Table 2.3).

Table 2.3: Trends in overweight (+1<BMI≤ +2) and obesity (BMI z-score > +2) among children and adolescent, 1997- 2009

	Overweight		**Obesity**		**Overweight and obese**	
	1997 (%)	2009(%)	1997(%)	2009(%)	1997(%)	2009(%)
Children (6-9 years)						
Boys	16.5	17.2	11.3	19.5	27.8	36.7
Girls	15.2	23.9	9.8	12.8	25.0	36.7
Adolescents (10-19 years)						
Boys	24.3	23.8	9.7	14.9	34.0	38.7
Girls	20.5	19.2	3.0	6.2	23.5	25.4
Total						
Boys	22.1	23.0	10.2	15.5	32.3	38.5
Girls	18.6	19.7	5.4	6.9	24.0	26.6

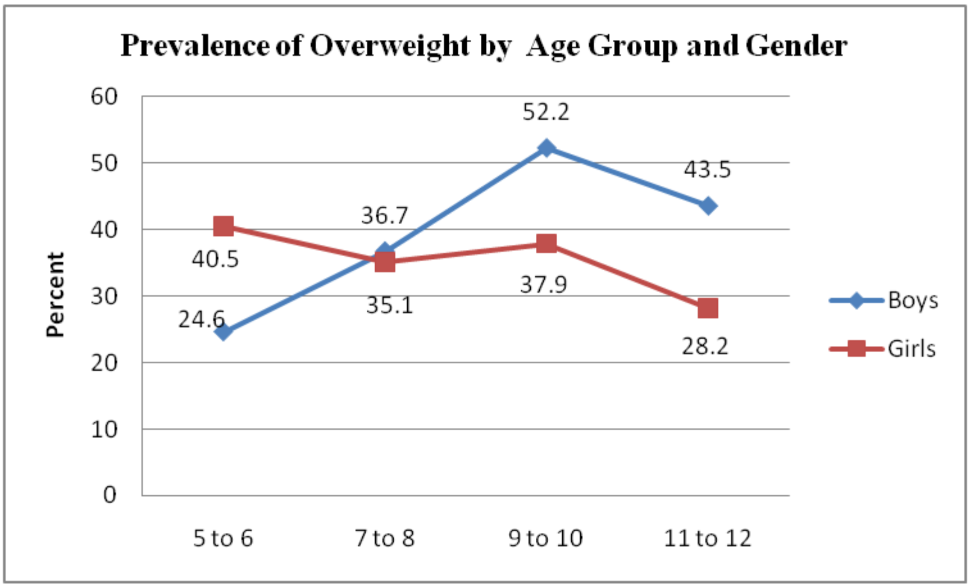
Source: Adapted from Nasreddine et al, 2012c

Results from the 2009 survey indicated a high prevalence of overweight and obesity among children, with increasing rates with age for both genders, reaching its highest at the age range of 9 to 10 years (45.2% and 20.0%, respectively) with a decrease at the age range of 11 to 12 years (35.7% and 15.7%, respectively) (Fig 2.4).This suggested that persistent obesity is established before age 11 years.

Figures 2.2 and 2.3 respectively present the prevalence of overweight and obesity in Lebanese children by age group and gender *(Akl, 2012).*The prevalence of overweight was higher among boys (52.2.0%) as compared with girls (37.9%) at the age of 9-10 years (Figure 2.2). The results also showed that 16.4 % of the study sample was obese; boys were almost two times more likely to be obese (20.8%) as compared with girls (11.4%). Odds of overweight were significantly lower among children living outside the capital Beirut, and higher among sedentary children and girls with higher maternal educational level *(Nasreddine et al, 2012b)*

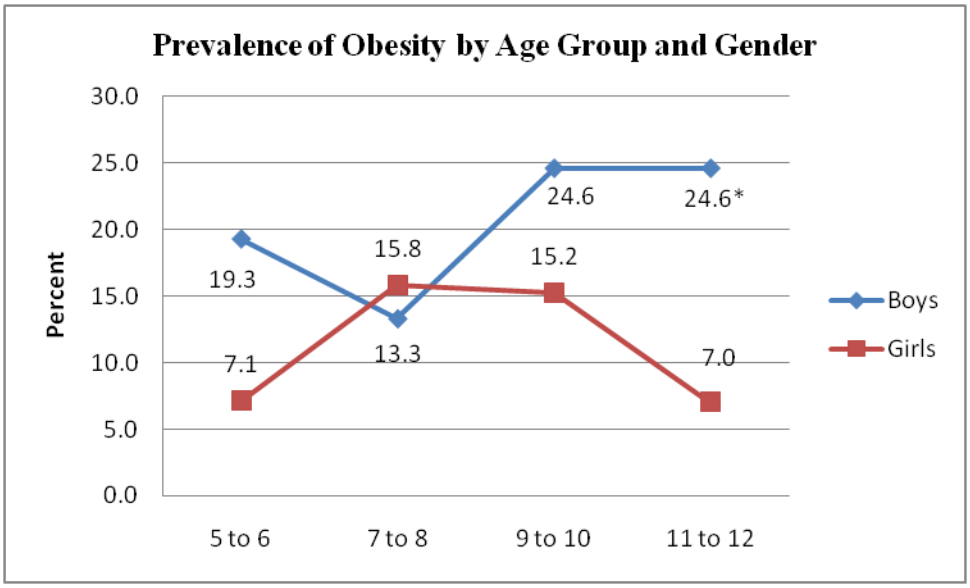
Prevalence rates of overweight and obesity were both found to be greater in boys as compared to girls in one study *(Akl, 2012)*, and this was in accordance with previous studies conducted in Lebanon *(Chakar et al 2006; Sibai et al 2003).* The findings are also in accordance with reviews *(Mirmiran et al, 2010),* that showed higher prevalence of childhood obesity in boys as compared to girls in the Eastern Mediterranean Region. This gender difference may be explained by several factors among which are cultural habits as well as nutrition and physical activity behaviours. In one study *(Akl, 2012),* boys were found to have significantly higher energy and fat intake, as well as a greater contribution to energy intake from chocolate and fast food as compared to girls. On the other hand, Lebanese girls are subject to a higher cultural pressure to maintain an acceptable body image as compared to Lebanese boys *(Chakar & Salameh, 2006).* Finally, it’s worth noting that girls usually begin their puberty-related growth spurt at an earlier age compared with boys(between 10 to 14 years vs. 12 to 15 years, respectively), which may also explain the greater gender difference in obesity observed for the age group of 9 to 12 year old. Thus, the longitudinal growth spurts that start in adolescence and that allow children to "grow into their height" could be compensating for some excess body weight *(Lobstein et al, 2004).*

<u>Fig.2.2</u>: Prevalence of Overweight by Age Group and Gender (%) in Lebanese children



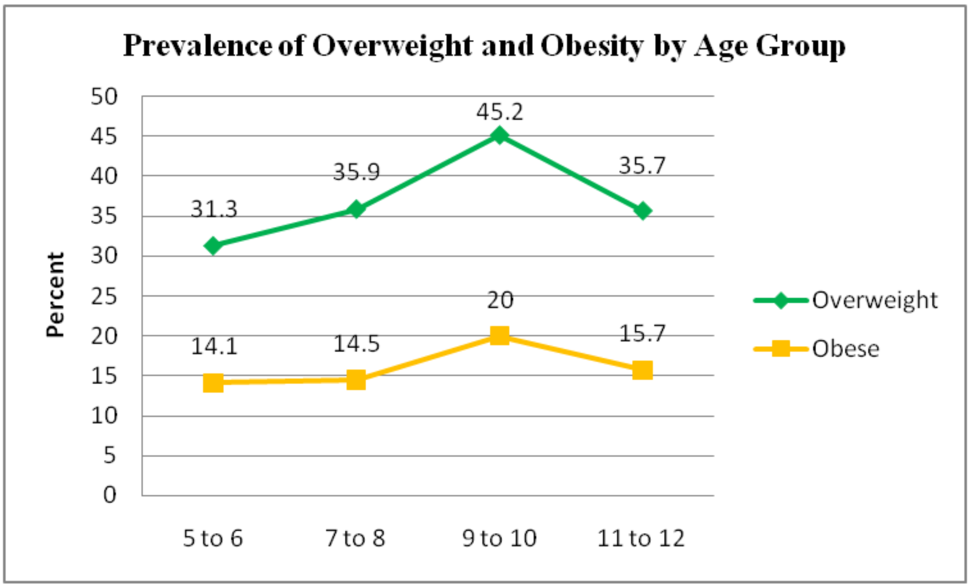
Source: Akl,2012

Fig.2.3: **Prevalence of Obesity by Age Group and Gender (%) in Lebanese children**



Source: Akl, 2012

Fig.2.4: **Prevalence of Overweight and Obesity by Age Group (%) Both genders, in Lebanese children**



Source: Akl, 2012

2.1.4 Health consequences of childhood obesity

Childhood obesity is an important determinant of adult health; 60% of children who are overweight before puberty will become overweight in their early adulthood. In addition, as the metabolic and cardiovascular profiles tend to track from childhood into adult life, the average age at which non-communicable diseases start is greatly reduced, resulting in an elevated risk of poor health and premature death *(WHO, 2008b).* Furthermore, obese children have a direct, increased risk of disease *(Swallen et al, 2005)*. For most non-communicable conditions resulting from obesity, the risks depend partly on the age of onset and duration of obesity. Obese children suffer from both short-term and long-term health consequences. Short term health consequences include metabolic abnormalities such as type 2 diabetes, non-alcoholic fatty liver disease and sleep associated breathing disorders. *(Haines et al, 2007; Schwimmer et al, 2003; Erler & Paditz, 2004).* Furthermore, social consequences related to stigmatization of obese children and adolescents are also common *(Dietz & Robinson, 2005).*

Table 2.4 summarises the various disorders related to childhood obesity by body system with their estimated prevalence in the paediatric population.

Table 2.4: Disorders related to childhood obesity

System	Disorder	Estimated prevalence in paediatric populations
Cardiovascular	Hypertension Left ventricular hypertrophy Atherosclerosis	2-4% Unknown 50%
Metabolic	Insulin resistance Dyslipidemia Metabolic syndrome	Unknown 5-10% 4% overall, 30% in obese
Pulmonary	Asthma Sleep apnoea	7-9% 1-5% overall, 25% in obese
Gastrointestinal	Non-alcoholic fatty liver Gastroesophageal reflux	3-8% overall, 505 in obese 2-20%
Skeletal	Tibia vara Slipped capital femoral epiphysis	1-8 persons in 100,000
Psychosocial	Depression	1-2% in children 3-5% in adolescents

Source: Adapted from Daniels, 2006

Several studies also showed that childhood obesity is associated with the metabolic syndrome (MS), a group of cardio metabolic risk factors *(Cook et al, 2003; Druet et al, 2006; Weiss et al, 2004)*. The prevalence of the metabolic syndrome in children tends to vary among countries. In the United States it is estimated that 30% of overweight adolescents *(Cook et al, 2003)* and 48.8% of obese children *(Dhuper et al, 2007),* meet the criteria for the metabolic syndrome. In Europe, an estimated 23.9% of obese children from the 25 countries of the European region were found to have at least three indicators of the metabolic syndrome *(Lobstein & Jackson-Leach, 2006).*

In the Middle East, limited data suggested the presence of high rates of MS and cardio metabolic risk factors in the paediatric obese population. In Iran, the prevalence of MS in obese children and adolescents was found to be the highest reported in the literature (41.9%) *(Esmaillzadeh et al, 2006)*.

The presence of metabolic syndrome abnormalities was also high in obese Lebanese children; 26.4% of obese and 4% of overweight children were identified as having MS, with a higher prevalence among girls than boys *(Nasreddine et al, 2010b)*. The most common metabolic syndrome abnormalities were: elevated waist circumference, high triglyceride and low high-density lipoprotein cholesterol levels. The prevalence of MS was comparable with those reported for England *(Viner et al, 2005),* and was higher compared with the prevalence reported in France *(Druet et al., 2006),* Spain *(Lopez-Capape et al, 2006)*, Brazil *(Ferreira et al., 2007)* and Japan *(Yoshinaga et al, 2005)*. Even though the metabolic syndrome as a disease category faces significant debate, the identification of its components in childhood provides important information about a possible risk for cardiovascular disease. Obese children with the metabolic syndrome suffer from the presence of early morphologic changes to the heart and blood vessels *(Toledo-Corral et al, 2009)*. However, this condition can be reversible if risks are identified early and treated effectively *(Battista et al, 2009; Ippisch et al, 2008).*

2.1.5 Psychosocial consequences of childhood obesity

Childhood obesity is linked with various psychosocial problems such as depression, low quality of life and low self-esteem *(Daniels, 2006).* Research has shown that children who are obese are more prone to unhappiness, and have a higher tendency of loneliness and anxiety *(Reilly et al, 2003)*. Long term studies demonstrated that depression is linked to body dissatisfaction and dietary restraints, particularly in girls *(Stice et al, 2000)*. Body dissatisfaction caused by weight problems affects girls differently depending of ethnic background. Studies showed that African American girls have a more positive body image than white, Hispanic and Asian girls and are less likely to be affected by body dissatisfaction *(Siegel, 2002)*. On the other hand, Erermis and colleagues *(Erermis et al, 2004)* found that half of their sample of obese adolescent was diagnosed with a major depressive disorder. Furthermore, increased symptoms of depression were observed among school girls with high BMI, and adolescents with the greatest BMI had the highest depression scores *(Goodman and Whitaker, 2002; Erickson et al, 2000).*

Many factors affect the development of depression in obese children. It has been found for instance, that children raised in cultures that do not stigmatize obesity may have a lower tendency to develop depression *(Brewis, 2003)*. This suggests that the subjective experience of obesity (being the victim of teasing and bullying, being in a culture that defames obesity) plays an important role in addition to BMI scores.

On the other hand a study found that overweight adolescents who had been teased by peers or family members were more likely to have increased suicidal thoughts and attempts (*Eisenberg et al, 2003).*

Studies have also shown that overweight children and adolescents tend to have difficulties with peer relationships *(Strauss and Pollack, 2003).*Obese children were more likely to have peripheral and isolated relationships in the network compared with their normal weight counterparts. However, a contrary finding from a study in the United Kingdom demonstrated that overweight nine year old girls were as popular as their normal weight peers *(Phillips and Hill, 1998).*

The presence of childhood obesity may have unfavourable consequences on childhood self-esteem. A study on a longitudinal sample of American children found that over a four year period, obese girls showed significantly decreased levels of global self-esteem compared with non-obese girls. Mild decreases in self-esteem also were observed in obese boys compared with non-obese boys. Consequently, by the age of 13 to 14 years obese boys and girls had significantly lower levels of self-esteem compared with their non-obese counterparts. Decreasing levels of self-esteem in obese children were as well associated with increased rates of sadness, loneliness and nervousness compared with obese children whose self-esteem increased or remained unchanged *(Strauss, 2000).*

Childhood obesity affects the child's overall wellbeing and self-esteem, increasing the risk of depression and even suicide. It is important to keep in mind the different sociocultural factors that may influence an individual's perception of obesity and in turn increase the vulnerability of a child to the negative effects of obesity on mental health. Moreover, these factors may be more complex to study than BMI measures.

In summary, obesity in children is a complex disorder. Its prevalence has increased so significantly in recent years that it is considered a major health concern of the developed and developing world. Statistics indicated that the prevalence of obesity is increasing globally in all paediatric age groups, in both sexes, and in various ethnic and racial groups.

Childhood obesity predisposes to many diseases both at the physical and psychosocial levels. This condition also increases the risk of adult-onset obesity, cardiovascular disease and several non-communicable diseases. Childhood obesity and its associated abnormalities will continue to increase significantly in many parts of the world in the coming years unless effective multi-component strategies are applied to prevent the progress of this epidemic *(James et al, 2006).*

Nutrition transition could be a factor for the increase of obesity prevalence in the paediatric population; this is described in the following section.

2.2 <u>Nutrition Transitions</u>

2.2.1 Global nutrition transitions

Throughout history, changes in ecological relationships have altered the diet and physical activity of populations and affected their disease patterns *(WHO, 2002).* The shift from the gathering and hunting period to agriculture has brought tremendous changes in the nutritional and disease profiles of populations *(Armelagos, 1990)*. During the last two centuries, an industrial revolution has been taking place in most countries of the world, causing important changes in the methods of food production, processing, storage and distribution *(WHO,1990).*The nutrition or dietary transition is a concept that describes these changes, as well as changes in food consumption and nutrient intake.

Popkin and Gordon-Larsen described two broad shifts in population size and its age composition and in disease patterns that occur simultaneously or precede the nutrition transition: the demographic and the epidemiologic transitions.

The demographic transition is characterized by a shift from a model of high fertility and mortality to one with low fertility and mortality. The epidemiologic transition is described as a shift from an era with high prevalence of infectious diseases to one with high prevalence of degenerative diseases. Both shifts are associated with modern urbanized lifestyles *(Popkin and Gordon-Larsen, 2004).*

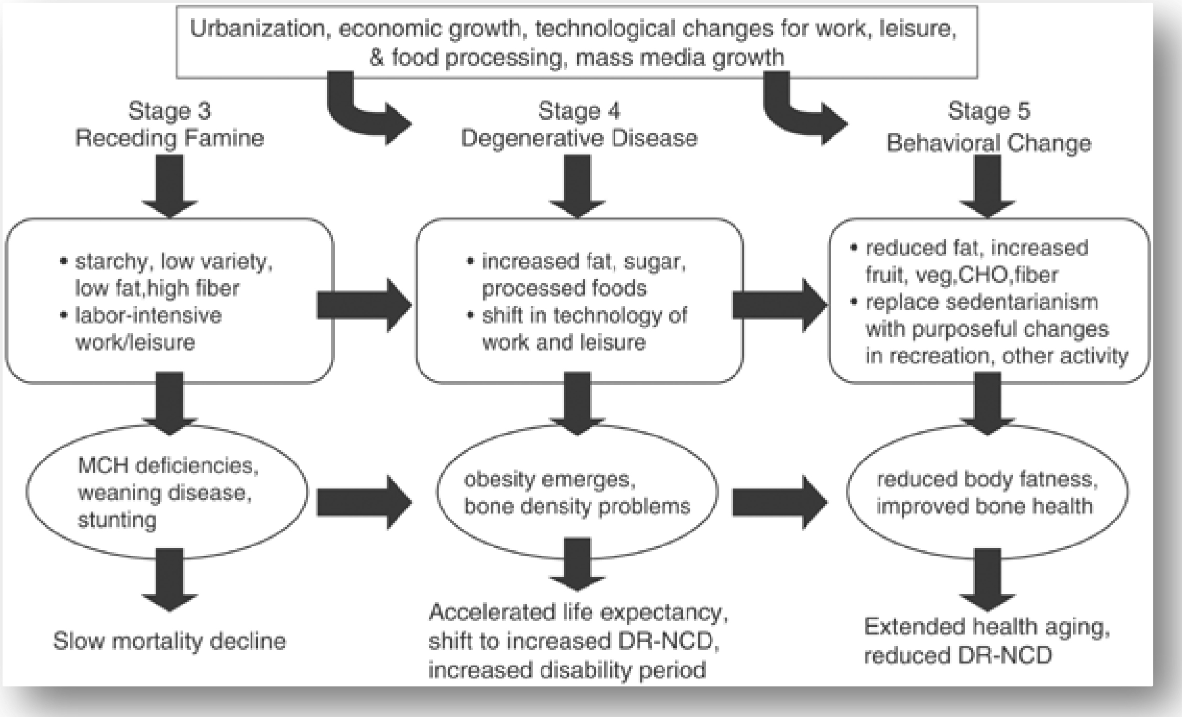
Dietary and physical-activity changes, reflected in nutritional outcomes such as changes in average stature and body composition, are referred to as the nutrition transition *(Popkin and Gordon-Larsen, 2004).*

Figure 2.5 illustrates the three stages of nutrition transition as described by Popkin and Gordon-Larsen.

The last three stages of nutrition transition are described by Popkin and Gordon-Larsen (2004) (Figure 2.5). In Stage 3 famine retreats as income rises. The consumption of fruits, vegetables, and animal protein increases, and starchy staples become less important in the diet. These changes in lifestyles in diet and activity cause the appearance of new disease problems and increased disability in Stage 4, specifically dietary related non communicable diseases (DR-NCD). Evidence has often associated the epidemics of diseases of the heart and blood vessels which are now major contributors to the burden of disease in both developed and developing countries with changes in behaviours, lifestyles, diets, physical inactivity, and smoking. A diet high in total fat, cholesterol and low in polyunsaturated fatty acids and fibre, along with an increasingly sedentary life, is characteristic of richer societies in this stage. These characteristics may have caused the increased prevalence of obesity and degenerative diseases. Urbanization, economic growth, technical change, and culture are considered among the factors achieving these changes through the stages. The desire to prevent or delay degenerative diseases and prolong health through ‘successful aging’ seems to be appearing in Stage 5. Government policies and health authorities have urged for behavioural changes in the diet and lifestyle of individuals in many developed countries, which is leading to an improved health through the reduction of obesity and other non-communicable diseases. Unfortunately, the earlier patterns of nutrition transition stages continue to exist in many geographic and socioeconomic populations.

This nutrition transition first started in the industrialized world, however, the world's low- and moderate-income countries have been experiencing a rapid shift from the stage of receding famine to the stage of nutrition-related non-communicable diseases. The next section describes the nutrition transition that has been occurring in developing countries in the last decades.

Figure 2.5 Stages of nutrition transition



Source: Popkin and Gordon-Larsen, 2004

This dietary transition first started in the industrialized world, however, the world's low- and moderate-income countries have been experiencing a rapid shift from the stage of receding famine to the stage of nutrition-related non-communicable diseases.

2.2.2 Nutrition Transitions in developing countries

Obesity or the new 'silent emergency' emerging lately in the developing world has been accompanied by rapid urbanization and changing diets *(Popkin, 2002).*

When studying the difference in nutrition transition between Western countries and the current developing world, Popkin noted that this shift occurred within a few decades in the developing countries compared to 100-200 years in the West *(Popkin, 2002).*

The prevalence of obesity and a number of other nutrition related non communicable diseases is increasing much faster in the low income and developing world than it has in the West.

Nutrition transition is touching more countries and more socio-economic groups within countries. In Brazil, a study that followed the nutritional changes of adult women between 1975 and 1997 found that obesity increased for low-income women and decreased for high income, furthermore, low-income women held the double burden of nutrition transition, as they were more susceptible to both underweight and obesity *(Monteiro et al, 2004).* Evidence indicates that socioeconomic status (SES) affects overall well-being and quality of life for women. Women of lower socio-economic status have been found to be less concerned with weight control. Studies have concluded that economic deprivation might lead to reduced access to healthy food which may contribute to obesity for women *(Jeffrey & French, 1996).* Women who live in lower SES neighborhoods have been also found to undertake less moderate physical activity compared with women in higher SES neighborhoods, thus receiving less health-promoting physical exercise (Lee et al, 2007). In addition, convenient access and knowledge of healthy practices are important environmental SES factors related to increased BMI in women *(Condrasky & Marsh, 2005).*

Countries like Mexico where the nutrition transition is very advanced, the population suffered from obesity both in rural and urban areas, though the crisis is more apparent in cities *(Barquera et al, 2009).* In countries such as India, the nutrition transition is still at its earliest stages and restricted in wealthier groups of the population *(Wang et al, 2009).*

The dietary changes that mainly affected the developing countries included shifts in intakes of fat, caloric sweeteners and animal sources of fat *(Popkin and Gordon-Larsen, 2004).*

Dietary changes started mainly with the increase in domestic production and imports of vegetable and seed oils. This was mostly due to the increased global production of vegetable fats and oils that affected vegetable fat price, supply and consumption. The effect of this shift was apparent in rich and poor countries; however the impact was greater on low-income countries *(Drewnoswski and Popkin, 1997).*

In the last several decades the overall trends showed a large increase in caloric sweeteners intake. It has been shown that all measures of caloric sweetener increased significantly as gross national product per capita of the country and urbanization increased. Caloric sweeteners accounted also for a larger share of both total energy and total carbohydrates consumed *(Popkin and Nielsen, 2003b).*

The increase in demand and production of meat, fish, milk and eggs is another feature of the nutrition transition of developing countries *(Delgado, 2003).* In China for example, the annual consumption of animal sources of fat more than tripled between 1952 and 1992 *(Popkin and Du, 2003a).* Intake of animal foods was also higher among urban residents compared with rural, and the intake was positively correlated with income level.

Data from China, Egypt, India, Mexico, the Philippines and South Africa expose a clear shift during the last twenty years toward diets high in saturated fats and refined foods. The share of cereals, legumes and nuts has declined *(The World Bank Group, 2007).*

The introduction of Westernized fast-food chains and dietary habits in developing countries seems to be another element in this nutrition transition responsible for the growing obesity epidemic *(Astrup et al, 2008).* Elements of fast food meals identified as accountable for the fattening process include: the large portion sizes, the high total fat content, the lack of low energy dense foods such as fruits and vegetables and the abundance of sugar loaded beverages *(Astrup et al, 2008).* It's worthwhile noting that fast food restaurants constitute an attractive venue for children and adolescents as these provide convenient and palatable food and drinks coupled with incentives such as free toys and playground.

The obesogenic environment that has emerged due to nutrition transition further infiltrated traditional lifestyles through other factors. These included the support toward motorized transport, increased sedentary employments and the attraction of TV and video games *(Prentice, 2006).* Countries such as China and certain regions of the Middle East have experienced a rapid shift from labour intensive, physically demanding occupations to less tiring work *(Popkin and Gordon-Larsen, 2004).* The acquisition of television and motorized vehicles increased significantly between 1989 and 1997; and even though children in developing countries such as China spend less time in screen time activities compared with their US counterparts, television viewing and other media activities are expected to increase if the US pattern continues. Furthermore, active transportation such as walking to and from school was considered as a significant source of physical activity among children in Russia, China and the Philippines *(Popkin and Gordon-Larsen, 2004);* a trend that is decreasing due to the reliance on motorized vehicles.

In the Eastern Mediterranean Region, countries can be divided into two groups with regard to nutrition transition; countries in advanced nutrition transition stage and countries in early nutrition transition stage *(WHO, 2009).* Countries in advanced nutrition transition stage are characterized by high levels of overweight and obesity and moderate levels of under-nutrition and micronutrient deficiencies. These include all countries of the Gulf Cooperation Council (GCC), the Islamic Republic of Iran and Tunisia. Countries in early nutrition transition stage include Egypt, Jordan, Lebanon, Libyan Arab Jamahirya, Morocco and Syrian Arab Republic. These countries have moderate levels of overweight and obesity, moderate levels of under-nutrition in certain population categories, and prevalent micronutrient deficiencies *(WHO, 2009).* Changes in food habits are noticeable in most of the above mentioned countries. Fresh fruits and vegetables, whole grains and pulses, fish, milk and dates made up the traditional diet. A gradual and significant rise in daily energy, protein, fat and refined carbohydrates supply and consumption per capita has been noticed over the past three decades in most countries of the Eastern Mediterranean Region *(Sibai et al, 2010)*. It is probable that such a shift in nutrition patterns and the sedentary lifestyle have contributed to the alarming rates of obesity in selected countries of the region *(Sibai et al, 2010)*.

<u>Lebanon's case:</u>

Lebanon's economy is characterized by a traditional services oriented culture based on trading, banking and tourism. Its central location linking the Mediterranean to the Arab world makes it an important commercial hub in the region. However, economic and social developments were hindered by a long civil war from the mid-seventies until beginning of the nineties.

The country's economy has been growing steadily since the end of the civil war in 1990, particularly due to the development of the service sectors. The population's access to affordable traditional energy dense and varied diet as well as to a westernized type of food has increased during the last decades *(Food Agriculture Organisation, 2007).* The increase in fat intake which is currently above the higher limit of recommendations has been noted. A study about food consumption patterns in Lebanon found many inadequacies in the diet of Lebanese adults; low intakes of fish and elevated consumption of fats were observed, as well as an intake of fruits and vegetables below the recommended amounts *(Nasreddine et al, 2006).*This shift to an atherogenic diet was coupled with an alarming increase in nutrition-related cardiovascular risk factors *(Nasreddine et al, in press).*

Similar to the global trends of fast food chain proliferation, Lebanon also witnessed the same phenomenon since the 1990s. Table 2.5 summarizes the development of international fast food chains in Lebanon over the last two decades.

Table 2.5 Fast Food chains location and distribution in Lebanon

	Population	Mc Donalds	Burger King	Pizza Hut	KFC	Hardees	Dunkin Donuts	Total Branches	Population per store
Beirut	390,503	9	7	8	6	4	7	41	9,524
Mount Lebanon	1,501,570	9	11	11	6	3	9	49	30,644
Bekaa	471,209	2		1	1		2	6	78,535
South	623,043	4	1	5	6	1	1	18	34,614
North	768,709	2	1	1	1	1	1	7	109,816
Total	3,755,034	26	20	26	20	9	20	121	31,033

Source: www.bklebanon.com, www.ddlebanon.com,www.mcdonalds.com.lb, www.americana-group.net, www.pizzahut-lb.com, Ministry of Social Affairs, 2008.

This fast expansion of the fast food chains started in 1992, and was enabled due to several factors:

- High investments in advertising of the big fast food brands and offers, targeting the youth with strong emphasis on TV sponsorships and charity events.
- Smart pricing strategies, with entry price points affordable to the lower mid socio-economic classes.
- Creative strategies with 24/7, home and online delivery services, offers and gifts

- Adaptation to local tastes and culture.
- Strategic locations on mains roads, with easy access for traffic, parking and drive through services.
- In addition hundreds of local chains and neighbourhood fast food restaurants proliferated in the country, offering accessible choices to consumer and gradually creating eat-out of home habits that are very convenient and attractive, especially to children.
- The Highest concentration and stores per capita is in the capital Beirut.

The Lebanese population nutritional status is characterised by a nutrition transition situated at the stage four as defined in the previous section on the nutrition transition stages. However this is not consistent across the entire regions of Lebanon. The micronutrient deficiencies and chronic malnutrition in young children, especially in the rural areas, persist alongside with the emergence of a high prevalence of overweight in all age groups, both in rural and urban areas (*Food Agriculture Organisation, 2007).*

2.2.3 Health consequences of nutrition transitions

Increased variety of foods often improves diet adequacy. However, the trend toward more fats, salts, sugars and refined foods in the diet, is contributing to the rising rates of obesity and chronic diseases worldwide *(Tucker and Buranapin, 2001).* Furthermore, the changes in dietary patterns coupled with those in physical activity (increasing sedentary behaviour and decreasing physical activity) are the major drivers in a population’s risk for weight gain (*Swinburn and Egger, 2004a,b; Prentice and Jebb, 1995; Popkin, 2005).* The health consequences of poor diets and physical inactivity have generally been considered diseases of the wealthy countries. In the USA the outcomes of increased energy intake are self-evident *(James et al, 2006).*The rise in obesity in both adults and children in the USA provides a most vivid illustration of the implications of these imbalances to the rest of the world. This obesity pandemic that originated in the US and crossed to Europe and other rich nations has penetrated even the poorest countries of the world *(Prentice, 2006).*

In most regions of the world, non-communicable diseases are considered leading causes of death, and the majority are taking place in economically developed or developing countries *(Murray and Lopez, 1997).* Strong facts confirm that unhealthy diets with insufficient physical activity are among the major causes for coronary heart diseases, type 2 diabetes, hypertension, strokes and cancer. A study on the association between dietary patterns and the risk of metabolic syndrome among Lebanese adults established a positive association of the Fast Food/Dessert pattern with the metabolic syndrome and hyperglycaemia whereas the Traditional Lebanese pattern did not show any association with the metabolic syndrome and its components *(Naja et al, 2011b).*

Amounts of fruits and vegetables in the diet as well as the quantity and quality of fat ingested and the intake of salt are associated with the prevention of non-communicable diseases. Maintaining ideal weight and taking adequate physical activity are also important ways of preventing chronic diseases *(WHO, 2002).* High intakes of fats and sugars in food and beverages have been shown to add to the burden of weight gain. These western diets are also responsible for the “nutrient dilution” of diets, where deficiencies in minerals, vitamins and essential fatty acids such as omega-3 can occur despite excess energy intake *(James et al, 2006)*.

Nutritionists have focused their concerns three decades ago on childhood malnutrition, and in particular the critical effects of poor growth and improper weight gain in infancy which resulted in under-nutrition, infections and death *(Stettler, 2007).* But today under-nutrition in childhood is not common, whereas obesity is prevalent in many developing countries. The World Health Organisation finds itself in need to manage this new pandemic of obesity and its associated non-communicable diseases, while the challenge of childhood malnutrition is still remaining in some countries *(Prentice, 2006).* This creates a “double burden” of disease that might devastate the health services of many low-income countries. The nutrition transition is linked to the escalating trends of non-communicable diseases. The number of persons with diabetes in the world is expected to double by 2030, based only on demographic changes *(WHO, 2009).* Policies to prevent non-communicable diseases are not among the priorities of the less industrialized countries, because under-nutrition and communicable diseases are still a significant burden *(WHO, 2002).*

However, in some countries going through the nutrition transition, going back to the traditional diet is the more sensible choice. It is a diet that still includes plenty of whole grains, fruits and vegetables with moderate amounts of animal products *(Vorster et al, 1999).* Some individuals in developed countries have returned to this type of dietary pattern to decrease their risks of non-communicable diseases *(Drewnowski and Popkin, 1997*). Indeed, there are policies in some countries to encourage and support the population to return to such diets. An example on this is the new eating concept the “New Nordic Diet” developed by The OPUS research project: 'Optimal well-being, development and health for Danish children through a healthy New Nordic Diet' in Denmark. The diet promotes fresh, traditional Nordic food products, and includes more fruits, vegetables and whole grains than the average Danish diet *(www.foodoflife.dk).* It also encourages the consumption of fish and home cooked meals, with emphasis on seasonal produce. The OPUS project focused on introducing this new meal concept into national school systems and to families with young children. Initial outcomes from the research project, led by Professor Arne Astrup showed promising results on weight loss when comparing the New Nordic Diet with the average Danish diet *(www.foodoflife.dk).*

A similar analogy is also present in the Mediterranean diet which is the traditional diet in Lebanon where the traditional foods consist of fruits, vegetables, olives and olive oil, whole-grains and legumes, dairy and fish. A study on dietary patterns and their association with obesity in a national sample of Lebanese adults found that only the Western pattern was associated with increased BMI and waist circumference compared with the other patterns among which is the traditional Lebanese diet *(Naja et al, 2011a).* The Western pattern identified was characterised by high consumption of fried foods, sweetened drinks, fast-food sandwiches and sweets. The authors concluded that these results validate interventions aiming at discouraging the intake of high energy dense foods provided by the western pattern and promoting the traditional Lebanese diet based on fruits and vegetables.

2.3 Intervention schemes to prevent childhood obesity

Prevention and treatment of childhood obesity is of critical importance, and poses one of today's major public health challenges. The following sections present a review on the best age group to target childhood obesity interventions, the behaviours mostly related to excess weight and the school setting as the site for the implementation of nutrition interventions to prevent and reduce childhood obesity.

2.3.1 Children's age group targeted in nutrition interventions

Evidence has shown that once obesity is set it is difficult to change it through intervention *(Luttikhuis et al, 2009).* And because childhood obesity is predictive of adult obesity, prevention strategies should start early in life and continue through adolescence and adulthood *(Brug, 2007).* Data from a number of studies provide clear evidence that increased BMI in childhood can predict overweight in adult life *(Goran, 2001; Kotani et al, 1997; Whitaker et al, 1997; Must et al, 1992; Monasta et al, 2010).*

One review showed that the probability of overweight at 35 years of age for overweight children increased with increasing age *(Goran, 2001)*; the prediction for adult weight was most accurate for BMI at 18 years of age with accuracy decreasing for BMI below 13 years of age. The author concluded that the “persistence of pediatric obesity into adulthood increases according to the age at which obesity is initially present.” The same was reported in other studies where approximately one-third of obese children grew into obese adults *(Kotani et al, 1997).* Whitaker et al (1997) found that over the age of 10 years, the child’s own overweight/obesity status was a better predictor of overweight later in life than having an obese parent. In a recent review of systematic reviews on early-life determinants of overweight and obesity, infancy obesity was found among the factors associated with later overweight and obesity *(Monasta et al, 2010)*. Furthermore, a longitudinal study noted that adult obesity was more strongly associated with childhood obesity than with the timing of puberty *(Freedman et al, 2003)*, which suggests that childhood obesity is the underlying factor for both age of onset of puberty and adult obesity. Moreover, the likelihood of an obese child becoming an obese adult increases with the age of the child independently of the duration of time that the child has been obese *(Deshmukh-Taskar et al, 2006).*

Efforts to prevent childhood obesity should be tailored specifically to each age group. An important age group to target when developing obesity prevention schemes is the transition from childhood to adolescence, which corresponds to the age of 9-12 years. Studies have shown that targeting children in this age group is conducive for the following reasons:

- Children in this age group gain more autonomy for making decisive choices with regard to dietary and physical activity behaviours *(Golan and Crow, 2004).*

- During this transition phase, children learn to make independent purchasing decisions since they are given allowances which they dispense to buy food without parental presence mainly at school *(Golan and Crow, 2004).*
- It is a critical age at which health behaviour changes can be achieved, whether positive or negative *(Demory-Luce et al, 2004).*
- A noticeable increase of overweight and obesity was observed in this specific age group globally *(Brug, 2007)* and particularly in the Lebanese paediatric population *(Akl, 2012).*

It is suggested that children aged 9-11 years are considered at an ideal age at which to intervene as they can be responsive to strategies aiming at preventing or reducing childhood obesity. On the other hand short term interventions in this age group may have limited impact on long term behaviour change due to the transformation in children's personality and attitude during the adolescent years. It could be argued that follow up interventions with this same group as they get older, may lead to a sustainable effect during their adolescent years.

There is a dearth of long-term follow-up data from short-term health promotion type studies in children *(Waters et al, 2011).* However, the limited data suggest that any positive effects of such interventions disappear over time. Waters and colleagues (2011) suggested the need for more studies in very young children and adolescents to assess how long the intervention effects last.

2.3.2 Energy balance related behaviours

Obesity does not have clear empirically verified universal causes, especially since various physiological mechanisms regulate body weight *(Bachman et al, 2006).* Research was not able to identify whether intake of one isolated food was associated with an increase in adiposity. However, overweight and obesity were mostly attributed to a sustained energy intake that is greater than energy expenditure and a variety of factors that include genetics, cultural, environmental and economics *(Lobstein et al, 2004).* This positive energy balance was considered as the consequence of specific health behaviours related to dietary and physical activity patterns. When aiming at preventing unnecessary weight gain, studies showed that strategies focusing on changes in dietary behaviours, leading to decrease in energy intake, and changes in physical activity and sedentary behaviours that would increase energy expenditure are key modifiable factors in the onset of obesity *(WHO, 2003a).*

The specific behaviours that make up the energy balance equation have been referred to as the energy balance-related behaviours *(Kremers et al, 2006).* Diet and physical activity patterns that can be a factor in weight gain may differ among groups depending on age, culture, gender and socioeconomic status. The energy balance behaviours mostly related to excess weight gain in school children were: breakfast skipping, sweetened drinks consumption, energy dense snacks intake, sedentary and physical activities *(Affenito et al, 2005; Bachman et al, 2006; Malik et al, 2006b; Sallis et al, 2000).*

<u>Breakfast consumption:</u>

Several studies have demonstrated that breakfast skipping is correlated with obesity in children *(Must et al, 2009; Patro & Szajewska, 2010; Duncan et al, 2008; bin Zaal et al, 2009; Tin et al, 2011; Utter et al, 2007).* It was suggested that efforts to encourage breakfast consumption among children and adolescents should be prioritized, as skipping breakfast was associated with increased BMI, decreased fruits and vegetables consumption and frequent consumption of unhealthy snack foods during the day. A recent national cross-sectional survey conducted in 2008 on 5-12 year old Lebanese children found that the odds of being overweight were significantly lower among children consuming breakfast daily *(Nasreddine et al, 2012a).* In this study, children who skipped breakfast had a 3 times higher risk of becoming overweight compared with those who consumed breakfast on a daily basis. The same relationship has been found in a study on dietary habits associated with obesity among adolescents in the United Arab Emirates. This study found that the risk of obesity decreased among girls and boys who always ate breakfast compared with those who never had breakfast *(Bin Zaal et al, 2009).* Breakfast consumption was also negatively correlated with BMI among African-American and white adolescent girls *(Affenito et al, 2005).*

Among attempts to explain mechanisms as to why breakfast skipping is related to obesity in children, the following has been suggested: skipping breakfast may be an indicator of unhealthy eating habits and may be followed by increased appetite later in the day with impulsive sacking, especially high energy-dense snacks *(Wyatt et al, 2002; Nicklas et al, 2001; Affenito et al, 2005; Tin et al, 2011)*. Other studies have shown that breakfast skippers compensated for their energy intake later in the day, particularly late at night *(Dubois et al, 2009).*

However, evidence has also shown that breakfast skipping is a technique used by some overweight adolescents and their parents as a way to lose weight *(Boutelle et al, 2002; Cheung et al, 2007; Utter et al, 2007; Timlin et al, 2008)*. Sjoberget al (2003) showed that the perception of being too heavy was associated with irregular breakfast consumption, independent of BMI, among Swedish adolescents. Therefore, being overweight or obese (as well as the perception of being overweight or obese) could also increase the likelihood of breakfast skipping.

There is still much debate about specific aspects of the association between breakfast consumption and obesity. Although current knowledge does not allow for a definitive conclusion, it provides a solid basis for further research. Interventions that target breakfast eating may be a potential strategy for preventing excess weight gain among children.

Sweetened drinks consumption:

Many studies have looked at the association of sweetened drinks consumption and weight gain among children and adolescents. Although the evidence is inconsistent *(Bachman et al, 2006; Malik et al, 2006b)*, several well designed studies have shown significant associations between sugar sweetened beverages and excess weight in children *(Newby, 2007).* Other studies have suggested that one of the contributing factors to the obesity epidemic in children seems to be the consumption of sweetened beverages *(Ludwig et al, 2001; Gibson and Neate, 2007; Malik et al, 2006b).* The risk of overweight was found to increase for each additional daily serving of sweetened beverage consumed *(Bachman et al, 2006).* The possible association between sweetened beverages consumption and increased overweight and obesity could be explained through several mechanisms among which are the excess caloric intake and the lack of effect of liquid calories on satiety *(Bachman et al, 2006).* Energy intake was higher for children with greater sweetened beverages consumption relative to those who consumed less; children consuming one regular sweetened drink a day had an average 10% more total energy intake than non-consumers *(Harnack et al, 1999).* The World Health Organization advocates for decrease in free sugars intake to no more than 10% of daily energy intake *(WHO, 2003b).*

Furthermore, it has been noted that reducing easy access to energy dense drinks may help to limit the chances of overconsumption of free sugars among children and adolescents *(Hill & Peters, 1998)*. Although several studies provided as well strong evidence for no relation between sweetened beverage consumption and BMI increase in children *(Bachman et al, 2006),* limiting intake of these types of drinks among children is advised, especially in light of the inadequate nutritional value of these beverages *(Newby, 2007).*Therefore, recommendations are in favour of interventions targeting high energy dense beverages intake among youth.

Frequent snacking, energy dense snacks

Low-nutrient energy dense foods and snacks are palatable though less satiating and available at low cost and convenient *(Drewnowski & Levine, 2003).*

The increase in the frequency of eating, namely snacking and the changes in the energy density of the diet have been lately suggested among the causes of the increased energy intake responsible for the observed growing epidemic of obesity in the world *(Kant and Graubard, 2006)*. Studies on the individual and environmental factors influencing children and adolescent eating behaviours indicated that desserts such as cookies and cakes were the major sources of snacks, and about a fourth of adolescents purchases from convenient stores were candy, gum and salty snacks *(Story et al, 2002)*.

Research on the eating habits changes that occurred in the past 30 years in the American culture showed that American adults and children are eating more snacks a day compared with what they used to have three decades ago *(Piernas and Popkin, 2010).* American children were consuming three snacks a day, providing more than 27 per cent of the total daily caloric intake. Desserts such as cookies and cakes remained the major sources of snacks, however, the greatest increases in energy dense foods were observed for salty snacks and candies *(Piernas and Popkin, 2010).* A nationally representative study conducted in the United Arab Emirates found that snacking is a major source of caloric intake among all age-gender groups; Emirati children consumed 23-26% of their total daily calories between meals *(Ng et al, 2011).* The number of snacks consumed per day was lower than reported in the US; however, the level of caloric intake was as high.

In the Eastern Mediterranean Region research on dietary pattern and physical activity of school children are limited.

A cross-sectional study conducted in Lebanese public schools on 2547 adolescents aged 11 to 18 years found an increased risk of overweight in adolescents with increased frequency of fried potatoes consumption, chocolate and eating out *(Chacar and Salameh, 2011).* The study looked at the obesity prevalence and intake of selected food consumption frequency and physical activity in a randomly selected sample of adolescents from 20 public schools. The list of food choices that were analysed included intake of chocolate, fried potatoes, salads, traditional platters, fruits and eating out per week. The results showed that chocolate, fried potatoes, fruits and traditional platters were consumed 4 to 5 times per week on average. Salads were consumed 3 to 4 times weekly. Students also reported eating out around 3 times per week.

Authors have concluded that targeting high energy snacks and drinks intake should be considered as a technique for calorie intake reduction among children and adolescents.

<u>Fruits and vegetables consumption</u>

Foods rich in water and fibre such as fruits and vegetables may help lower the diet's energy density. Reviews on the relationship between fruit and vegetable intake and childhood adiposity resulted in conflicting conclusions *(Newby, 2009; Tohill et al, 2004).* While Fruits and vegetables consumption has been suggested as a beneficial component in weight management and was associated with low BMI measures in some studies *(Rolls et al, 2004; Lin and Morrison, 2002)*, others did not find any protective effect of fruit and vegetable consumption on the risk of childhood obesity *(Newby, 2009).* In Lebanon, a cross-sectional study on a sample of adolescent children aged 11 to 18 years found that frequency of fruits consumption was associated with a lower risk of being overweight *(Chacar and Salameh, 2011).*

The lack of evidence showing an association between fruit and vegetable intake and weight gain in childhood does not mean that these types of foods should not be encouraged. Recommendations to increase fruits and vegetables consumption have been suggested as an obesity prevention technique by health agencies *(WHO, 2002).* Reviews on the effectiveness of school-based interventions that encourage fruit and vegetable consumption found that seventy per cent of the studies reviewed were successful in increasing fruit and vegetable consumption *(de Sa and Lock, 2008).* One study resulted in both an increase in intake and reduction in body weight *(De Sa and Lock, 2008).* The school-based European Pro-Children study which focused on fruit and vegetable intakes showed that, in the short-term, school-based interventions are favorable methods to increase fruit intake *(TeVelde et al., 2008).* However, long term effects are needed to observe any changes on body weight status.

Physical activity and sedentary behaviour

Regular physical activity is widely recognised as an efficient measure for preventing many diseases among which obesity and overweight. However, studies reported that levels of physical activity continued to be low among all age groups *(Troiano et al, 2008).*

In the Eastern Mediterranean Region, although data on physical activity are limited and difficult to interpret, studies have reported low levels of physical activity among children and adolescents. A study measuring physical activity in obese and non-obese 8-12 year old boys in Saudi Arabia found that active boys had significantly lower BMI and body fat percentage compared with their inactive peers *(Al Hazzaa, 2007).* In Lebanon, findings from a national study on adolescent obesity and physical activity suggested that children who do not exercise were over two times more likely to be obese than children who do *(Hwalla et al, 2005).* Odds of overweight were also significantly higher among sedentary children, in a recent study conducted on a group of 9 to 11 year old children *(Nasreddine et al, 2012b).* Another study on 1000 adolescents aged 14 to 18 years randomly selected from nine private and public schools in Lebanon found that normal-weight boys reported higher physical activity scores than obese boys and normal-weight girls reported higher leisure time and total physical activity than obese girls *(Fazah et al, 2010).* The same was noted in a cross-sectional study on adolescents aged 10 to 18 years selected from public schools in Lebanon, where physical activity was associated with a lower risk of being overweight *(Chacar and Salameh, 2011).*

It is not clear whether children gain weight because of lack of sufficient physical activity or because overweight youngsters do not engage in physical activity. This cause and effect question remains unanswered. Obese children suffer nearly twice as much muscle and bone pain as normal-weight children, making it difficult for them to exercise. A study of 2,459 children aged between two and 17 found that those who were obese up to the age of 11 were 1.86 times more likely to have ‘musculoskeletal problems’ in daily life than their ideal weight peers *(Krul et al, 2009).* It is also suggested that overweight adolescents are troubled by the metabolic cost of their excess mass which leads to poorer performance during sustained exercise *(Norman et al, 2005).* Consequently, it is assumed that a vicious cycle results in which being overweight, having musculoskeletal problems, and a low fitness level, combine to result in overweight children being less physical activity. There is also some evidence that overweight children are embarrassed about doing team sports, and are less confident in their ability to overcome barriers to physical activity *(Trost et al, 2001).*

Initiatives to promote physical activity from a young age are warranted. However, exercise recommendations for overweight children should be achievable for all children, be enjoyable, and should focus on activities that can be sustained *(Waters et al, 2011).* Such interventions will help enhance self-efficacy perceptions regarding exercise in obese children.

As encouraging physical activity among youngsters can be challenging, especially in the era of Xbox, PlayStation and Facebook, children can be motivated to exercise by finding a sport they might like to play. This will probably be more fun than just running on a treadmill or walking around the neighborhood. Exercise should be presented to children as a treat; Kids like to have fun, and they like to have a choice about what they do *(Lipnowski& LeBlanc 2012).* A variety of options should be offered to children from unstructured play such as Frisbee or skateboarding to more structured activities such as team sports. It is important to let them figure out which ones they truly enjoy. Getting the whole family to be physically active in the evening or on weekends is another important behaviour to encourage. Playing games and sharing outdoor activities are not costly and can be sustained overtime. Activities should be kept carefree and low-key, rather than overly serious or competitive. On the other hand, school-age children are at a good age to start some structured activity, such as dance classes, basketball or school team sports. Encouraging after school play especially when friends come over, as opposed to television viewing and computer games, is another behaviour amenable to change *(Lipnowski& LeBlanc 2012).*

Studies have also shown that Improving children’s skills in and enjoyment of physical activity might provide them with alternatives to sedentary behaviours *(Sallis et al, 2000).* Sedentary time is viewed as a product of time spent in specific sedentary behaviours such as TV viewing, playing electronic games or talking on the phone *(Biddle et al, 2004; Marshall et al, 2006).* Effective strategies aiming at reducing sedentary behaviours in children are scarce. Some studies were effective in reducing weight gain and decreasing TV viewing among children in the short-term *(Campbell et al, 2001).* Other studies used behaviour modification sessions encouraging children to reduce screen-based behaviours and find physical activity alternatives *(Salmon et al, 2005).* More than half the children reported reducing their TV viewing; however, less than half reported increasing their physical activity.

Thus, it is important to consider both the physical activity and sedentary behaviors of children, to get useful information about how to tailor interventions to specific groups *(Jago et al, 2010)*. Studies showed that some very active children participate in sustained physical activity periods during team sports and later spend the rest of their day in screen time activities *(Jago et al, 2005).* Other children may pursue similar sedentary behaviours but are also inactive the rest of the day. The time of day or week when children are sedentary or active should also be considered in order to focus the interventions across critical time points during the day or the week *(Jago et al, 2010).* Children who are active at school but less in the period immediately after may benefit from interventions targeting after-school physical activity. Similarly, developing ways to encourage sedentary children to be more active during the week-end is quite important, especially if those children are active during break periods and physical education lessons at school.

2.3.3 School-based interventions to prevent childhood obesity

The majority of obesity prevention studies, aimed specifically at children, have used the school setting. Schools offer many possibilities to influence nutrition and physical activity. The advantages of the school setting are numerous; nearly all children in most countries, including Lebanon, attend school and so an intervention delivered within a school can reach the majority of children in a given population; children spend a considerable amount of time at school, and it is possible to incorporate nutrition education into an existing curriculum. Schools can also offer a great opportunity for a health supporting environment by providing healthy food choices and access to sports and active leisure time *(Brown & Summerbell, 2008; Flynn et al, 2006; Doak et al, 2006).*

While there are many convincing arguments supporting health promotion in schools, many have questioned the capability of this setting to make an effect in health outcomes *(St Leger, 2004).* Behaviour change interventions using the school setting cannot be entirely successful if they operate in isolation from the Obesogenic environment in which the child evolves. Young people are influenced by many factors amongst which are the family, peers and media. Research has shown that children's health is also affected by important social determinants namely the family environment and its socioeconomic status *(St Leger, 2004).*

While schools are considered as one component influencing children's health status, effective interventions could be achieved when the school setting is used to provide a means for the delivery of programmes and services and acts as the link to other settings *(Canadian Institute for Health Information, 2003).*

Over the past decade, a number of studies have been conducted to evaluate the effectiveness of school-based interventions which aim to prevent childhood obesity *(Shaya et al, 2008; Doak et al, 2006).*

Several reviews have discussed the effectiveness of interventions intended to prevent obesity in children *(Summerbell et al, 2008; Shaya et al, 2008; Doak et al, 2006).* Most of the interventions were conducted in the USA, Australia and Canada, and the authors found strong evidence supporting the beneficial effects of programmes on BMI especially for interventions targeting six to 12 year old children.

The majority of interventions published within these reviews included health education on diet, physical activity or both. Most of the studies targeted children aged 6-12 years. The programmes used a large range of components among which behaviour theories and family involvement and it was not possible to differentiate which of these components helped the most in the success of the interventions. However, authors concluded that combining educational and environmental components might give better results in reducing obesity in children and adolescents *(Summerbell et al, 2008)*.

School-based interventions can be classified as long-term or short-term *(Summerbell et al, 2008;Shaya et al, 2008)*, where long term interventions have a duration of one year or more, and short term interventions have a minimum duration of three months and a maximum of one year. Most interventions produced a positive impact on eating practices and food choice determinants.

The next section presents a review of some major school based interventions conducted in the USA and Europe where the main component or one of the components was the promotion of healthy nutrition or physical activity or combination of both and targeted children in primary schools (6-12 years).

Table 2.6 displays the main features of the school-based interventions reviewed with a summary of the main results of each study.

Table 2.6: Summary of major schools interventions

Study	Participants	Duration	Outcome measures	Intervention components	Impact
APPLE Taylor et al (2008)	New Zealand Age:5-12 years n = 572	2 years +2 years follow up	- Anthropometric measurements - Blood pressure heart rate - 7 days recall of physical activity - Recall for television viewing time	Nutrition and physical activity intervention: - Increased non-curricular physical activity - Nutrition based initiatives - Provision of free fruits	- Lower adjusted BMI z score in intervention compared with control - Lower prevalnece of overweight at follow up in intervention group - Higher physical activity in intervention group - Decreased time in sedentary activities and more time spent in moderate to vigorous activity in intervention group.
APPLES: Active Programme Promoting Lifestyle in Schools Sahota et al. (2001)	UK: England schools children Age: 7-11 years n = 613	1 year	- Anthropometric Measurements - Dietary recall - Frequency of Physical activity and sedentary behaviours - Psychological measures	Nutrition & Physical activity intervention: - Training of teachers &catering staff - Parents involvement - School action plans to promote healthy eating and physical activity - Changes in school meals	- No difference in the change of BMI between children in intervention and control groups. - Small Behavioural changes observed in intervention children as well as higher consumption of vegetables - Successful changes at school level: improvement in school meals and physical education program - Children scored higher for knowledge - Satisfied Teachers
Be Active Eat Well Sanigorski (2008)	Australia: Age: 5-12 years n = 2184	3 years	- Anthropometric measurements - BMI, BMI z score - Incidence/prevalence of overweight and obesity	Nutrition and physical activity intervention: - In class nutrition programme - Intervention in canteens - After school physical activity/ active transport to schools - Screen time activities - Media & community involvement	- Lower increases in weight, waist circumferance, BMI z scores and waist to hip ratio in intervention group conpared with control. - Prevalence of overweight/obesity increased in both groups with no difference in incidence between groups
CATCH: Child & Adolescent Trial for Cardiovascular Health Luepker et al. (1996)	USA: United States children & their parents Age: Grade 3 to 15 n = 5106	3 years	- Blood pressure, serum lipids and other laboratory results - Recipe and menu analysis - Observation of type and intensity of children's activities & behavior - Dietary intake measurement: 24 hour recall - Anthropometric	- Changes in school food services - Enhanced physical education - Classroom health curricula - Family education	- Significant institutional changes in food service and physical education. Children made significant changes in eating and physical activity behaviour. - No significant differences were observed in physiological measures.
CHOPPS: Christchurch Obesity Prevention in Schools. James et al. (2004)	UK: England school children Age: 8-9 years n = 644	1 year	- BMI - proportion of overweight children - Carbonated beverage and water consumption	Nutrition intervention: - Discourage consumption of carbonated beverages - Replace it by water	- Modest reduction in intake associated with significant decrease in overweight and obese children - A follow up of 2 years showed no significant and number of overweight increased

Table 2.6: Summary of major schools interventions (cont'd)

Study	Participants	Duration	Outcome measures	Intervention components	Impact
Diet and Nutrition intervention in Chile Kain (2004)	Chile: Age:10-11 years n = 2375	6 months	- BMI - Triceps skinfolds - waist circumferance - Fitness	Nutrition and physical activity intervention: - Nutrition education for students and parents - Healthy foods in kiosks - Additional Physical activity sessions	- No difference in fatness between groups - Decrease in waist circumferance in intervention but not in control group - improved physical fitness for boys and girls in intervention group compared with control
Fernandes (2009)	Brazil: Brazilian school Age: 7-9 yrs	16 weeks	- Prevalence of overweight and obesity - Dietary recalls	Nutrition education program - 8 sessions in total	- No changes in the prevalence of overweight and obesity - Consumption of prohibited foods decreased in both groups - Consumption of mass produced snacks increased in control and decreased in intervention - Increase in the consumption of fruits in both groups
Health & Nutrition Education program Manios et al. (1998, 1999, 2002)	Grece: Primary school children of Crete Age: 5-7 years n = 5681	3 years 10 years follow up	- Anthropometric Measurements - Serum cholesterol - Fitness indices - Body fat - Dietary intake - Exercising habits - Health knowledge score	Nutrition & Physical activity intervention: - Classroom nutrition curriculum - Physical activity component - Family involvement	- Positive outcome of obesity indices and serum lipids - No significant in dietary changes - After follow up (10 years): encouraging changes in blood pressure, micronutrients intake and PA - PA level: Better effect on boys
KALEDO Amaro (2006)	Italy: Italian School children Age: 11-13 yrs n = 291	2 years	- Anthropometric Measurments - Physical activity - Nutrition knowledge - Dietary intake	Nutrition intervention: - Board game to increase nutrition knowledge. One play session per week	- No differences in BMI between intervention and control - Increase in nutrition knowledge - Increase in weekly vegetable intake - No difference between groups in physical activity
Kipping (2008)	UK: Age: 9-10 years n = 531	5 months	- Time spent on screen time activities - BMI - Physical activity	Nutrition and physical activity intervention: - Lessons on healthy eating - Lessons to increase Physical activity - Lessons to reduce TV viewing	- No significant difference between groups in time spent on scr領n time activities - No difference in BMI between groups - No signficant difference in active transport to and from school
Pathways Caballero et al. (2003)	USA: American Indian elementary schoolchildren Age: 8-11 years n = 1714	3 years	- Training Evaluation forms - Physical education calendar - Classroom teacher/curriculum checklist and interview - Teacher training attendance - Student & adult evaluation form - Field notes form - Student questionnaire	Nutrition & Physical activity intervention: - Culturally classroom curriculum to promote healthy eating and increase PA. - Food service intervention (lowering fat in meals) - Family program	- Significant positive changes in fat intake and in food and health related knowledge & behaviours of 7-10 year old children - No significant changes detected on obesity indices.

Table 2.6: Summary of major schools interventions (cont'd)

Study	Participants	Duration	Outcome measures	Intervention components	Impact
Planet Health Intervention Gortmaker et al. (1999).	USA: U.S schools children Age: 10-12 years n = 1295	2 years	- BMI - Triceps skinfold - Food frequency -Physical activity -TV & video measures	Nutrition & Physical activity intervention: - Reducing television viewing - Increasing PA - Decreasing consumption of high fat foods - Increasing consumption of fruits and vegetables	- Significant decrease of obesity among female students - No significant differences among male students - Reduced television viewing among both girls & boys. - Increased fruits & vegetable consumption in girls
PRESTO Damon et al (2005)	Austria: Austrian schools children Age: 10-12 years n = 135	14 weeks +10 months follow up	- Anthropometric measurements - Dietary recalls - Nutrition knowledge	Nutrition & Physical activity intervention: Sessions Delivered by multi-professional team.	- Significant increase in knowledge in intervention group. - No improvement in BMI among overweight children
Reed (2008)	Canada; Age: 9-11 years n = 268	1 year	- Cardiovascular fitness - BMI - Total Cholesterol, HDL, LDL, Apo B, C reactive protein	Physical education intervention: '- In class physical activity - Scheduled physical education sessions - Extracurricular activities - family & community involvement	- Increase in fitness in intervention group compared with control - Decreased blood pressure in intervention group compared with an increase in the control - No difference in BMI and serum cholesterol between groups
SWITCH program Gentile (2009)	USA: Age: 9 - 10 yrs n = 1323	8 months	- Anthropometric Measurements - Screen time - Fruit & vegetable intake - Physical activity	Nutrition & Physical activity intervention: - Behaviour switch - Class curriculum - Social marketing in community - Family program	- No significant difference on BMI between groups - No significant difference on physical activity between groups - No significant difference on physical activity between groups
The Sandy Lake Saksvig et al. (2005)	Canada: Ojibway-Cree students Age: 7-11 years n = 122	1 year	- Anthropometric status - Dietary intake: 24Hour recall - Knowledge and behavior	Nutrition & Physical activity intervention: - Nutrition education - Healthy school meals - Adding environmental component	- Significant Association with meeting the age + 5g/day fiber - Significant increase with children's knowledge of healthy foods. - Significant increase in purchase healthy foods (home and school environment)
Wellness, Academics & You Spiegel et al (2006)	USA: Age: grades 4 & 5 n = 1191	5-6 months	- Anthropometric measurements - Diet and physical activity surveys	Nutrition and physical activity intervention: - Integrated health curriculum - 10 minutes Aerobic activity preceded intervention classes	- Decrease in BMI in intervention group but not in control group - Reduction in overweight and at 'risk of overweight' in intervention group but not in controls. - Higher increase in fruits and vegetable consumption in intervention group - Increase in physical activity levels at home and school in intervention group, only slight increase in light activity in control group.

Multicomponent interventions generally combined educational and environmental components designed to influence diet and physical activity behaviours in school children. Amongst these interventions are: the multisite school-based study, Pathways *(Caballero et al, 2003*), APPLES (Active Programme Promoting Lifestyle in Schools) a randomised controlled trial conducted in ten primary schools in England *(Sahota et al, 2001a,b),* the multi-centred randomised Child and Adolescent Trial for Cardiovascular Health (CATCH) study *(Luepker et al, 1996),* The Sandy Lake school-based programme in Canada *(Saksvig et al., 2005),* and PRESTO, an Austrian school-oriented pilot project *(Dämon et al, 2005).* Although these programmes produced significant positive changes in students' health related knowledge and behaviour, such as fat and vegetable intake, no significant changes were detected on obesity indices. Several reasons were stated for the lack of effect in reducing risk factors for obesity. These included the programme duration and the fact that the families were not targeted directly *(Sahota et al, 2001a,b).* The one year intervention period with a population-wide focus may not be long enough to have a noticeable effect on obesity indices, especially considering that school-based programmes of longer duration have not demonstrated an effect either *(Caballero et al, 2003*). However, it is worth noting that these studies reported a significant increase in the purchase of healthy foods, suggesting that the programmes positively impacted the home environment in addition to the school environment *(Saksvig et al., 2005).*

While the previously mentioned studies did not show any effect on obesity, others were successful in inducing change on some indicators of obesity. Among these studies is the Health and Nutrition Education Programme in primary school children of Crete *(Manios et al, 1998, 1999, 2002).* The study showed positive outcomes regarding obesity indices and serum lipids, and as no dietary changes were observed, the positive effects on obesity parameters could be explained both by the increased physical activity at school and out of school hours. Furthermore, there was an adequate level of parental involvement in the programme *(Manios et al, 1999)*. Other objectives helping in achieving positive results on weight change included in addition to the parent support and education programme, improvements of cooking practices in food outlets. The Be Active Eat Well intervention a multifaceted community capacity-building programme conducted in Australia *(Sanigorski et al, 2008),* effectively slowed the rate of weight gain in intervention students compared with controls over a period of three years. Similar results were observed in another intervention that engaged the wider community, the APPLE intervention based in New Zealand *(Taylor et al, 2006).*The APPLE intervention worked on a community based programme that focused on increasing physical activity outside school. The programme significantly decreased students BMI-z scores in intervention group compared with control without reducing the prevalence of overweight and obesity. Authors concluded that community wide, capacity-building approaches are effective interventions to reduce childhood obesity, however, efforts to establish long term maintenance of anthropometric changes and project sustainability are warranted *(Sanigorski et al, 2008).*

Studies combining diet and physical activity interventions were more likely effective in inducing changes in BMI. However, amongst interventions using only nutrition education component and affecting weight is the Christchurch Obesity Prevention in Schools (CHOPPS); a school-based year-long intervention in England, aimed to discourage children from drinking carbonated beverages. A modest reduction in intake was observed and was associated with a decrease in the number of overweight and obese children *(James et al., 2004b).* However, a follow-up study showed that after two years, the difference was no longer significant in the control and intervention groups, and the number of overweight had increased in both groups *(James et al., 2007).* This study indicated the need for occasional refresher sessions during the follow-up period as well as long-term public health strategies to discourage the consumption of these sugary drinks as part of a healthy lifestyle. It is also important to note that adolescent eating patterns are influenced by individual and social factors that might affect their compliance compared with younger children. With increasing age, adolescents are less affected by family and home factors, and there is an increase in peer influence over the type of foods consumed *(Jenkins &Horner, 2005).* Follow-up intervention studies with older children should take into consideration these factors, in addition to individual aspects such as food preferences, self-attitude and autonomy, to ensure compliance in this age group. There is also evidence that peer-led health promotion interventions appear to do well in adolescents *(Stock et al, 2007),* and different approaches should be used when developing interventions for children at different ages.

In conclusion, reports on effective interventions to prevent obesity in school children suggested that success factors for the development of useful programmes should combine the following:

1. Include healthy eating and physical activity promotion and awareness as part of the school curriculum.
2. Spread physical activity sessions along the week and increase frequency with special emphasis on afterschool active play and active transport to school.
3. Provide good nutritional quality foods within the school food service.
4. Solicit support from the home environment to encourage the adoption of healthier food and activity habits.
5. Involve the wider community in order to use existing capacities and resources to ensure sustainability.

Additional strategies that proved to be successful in school-based interventions were programmes underpinned by health behaviour theories and using strategies such as family involvement, interactive learning and culturally sensitive programmes. These strategies are reviewed in detail in the following section.

2.4 Theories and determinants used in school-based interventions

2.4.1 Theories and behavioural change

Current Health promotion engages more than simple education about healthy practices, it comprises efforts to change behaviour at the individual, organisational and community levels. With such behavioural changes, public health programmes may be successful in helping people maintain and improve health, and decrease the risk for diseases. However, not all health programmes and projects are equally successful in promoting behavioural change. Those most likely to accomplish desired results are based on a clear understanding of targeted health behaviours, and the environmental background in which they take place *(Redding et al, 2000).* Health behaviour theory can play a vital role all through the programme planning procedure.

A theory presents an organised way of considering events or situations. It is a set of concepts, definitions, and propositions that clarify or predict these events by illustrating the relationships between variables *(Babbie, 2003).*Theory provides a plan for studying problems, developing proper interventions, and evaluating their successes *(National Cancer Institute, 2005).* Planners and researchers can use theory to help them identify the most appropriate audience, and a means for bringing about change and outcomes for assessment. Interventions that develop from a complete planning process, and use health behaviour theories, are more likely to be effective. Although knowledge constitutes a requirement to behaviour change, it does not necessarily elicit one *(Sahay et al, 2006).*

2.4.2 Overview of major health behaviour theories

Most health behaviour and health promotion theories were adapted from the social and behavioural sciences. They represent various fields, such as psychology, sociology, anthropology, consumer behaviour, and marketing *(National Cancer Institute, 2005).* Theories and models currently being used in the field of health education are numerous. The most common behavioural models supporting school-based interventions aimed at preventing obesity are *(Summerbell et al, 2008; Sharma, 2006):*

- The Health Belief Model
- The Transtheoretical model /Stages of Change Theory
- The Theory of Reasoned Action/Planned Behaviour
- The Social Learning or Social Cognitive Theory.

2.4.2.1 The Health Belief Model

The Health Belief Model (HBM) was one of the first theories of health behaviour, and remains one of the most widely recognized in the field. This model proposes that people's faiths about whether or not they were at risk of disease, and their awareness of the benefits of trying to avoid it, influenced their willingness to act *(Strecher and Rosenstock, 1996).* According to the HBM developers six main constructs influence people's decisions about whether to take action to prevent, monitor for, and manage sickness *(Redding et al, 2000)*. People are ready to act if they: believe they are vulnerable to the condition (*perceived susceptibility*); believe the condition has serious outcomes (*perceived severity*); consider that taking action would reduce their susceptibility to the condition (*perceived benefits*); trust that costs of taking action (*perceived barriers*) are offset by the benefits; are exposed to factors that encourage action (*cue to action*) ; and finally are optimistic in their ability to successfully achieve an action (*self-efficacy*). Critics to the HBM declare that the first step involved in this model depends on how much individuals believe they are susceptible to a certain condition, and it has been identified that people tend to underestimate their susceptibility to disease *(Redding et al, 2000).*

2.4.2.2 The Transtheoretical model/Stages of Change Theory

The Transtheoretical model/Stages of Change was first developed by Prochaska and DiClemente*(1983, 1997).* The model's basis is that behaviour change is a process, not an event; as persons try to change behaviour, they shift through five stages: *precontemplation*, *contemplation*, *preparation*, *action*, and *maintenance.* As they develop awareness of the situation, they begin contemplation of taking action. In the Preparation phase, persons will seek social support and make plans for action. The actual adoption of the new behaviour is the Action phase. Maintenance is a lifelong process; it is when individuals work to keep the new attained behaviour. This model is circular, not linear, and occasionally they may fall back into the old behaviour, but can re-enter the process *(Debarr, 2004).* The advantage of the Transtheoretical model lies in its acceptance of lapses and relapses and in preparing people for their behaviour change. They may cycle into this process frequently, and it can shorten at any time. Criticisms of this theory include the notion that human behaviour is multi-dimensional and cannot be categorized into discrete stages, and that people do not all start at the same stage *(Lenio, 2006; Bridle et al, 2005).* Other researchers *(Kraft et al, 1999)* raise concerns about the time frame of the contemplation stage, and whether people are able to plan that far in the future.

2.4.2.3 The Theory of Reasoned Action/Planned Behaviour

The Theory of Planned behaviour *(Ajzen, 1991a)* stems from the Theory of Reasoned Action *(Ajzen and Fishbein, 1980)* and looks at the relationship between behaviour and beliefs, attitudes, and intentions. Both theories presume that behavioural intentions the most important determinant of behaviour; the best way to predict someone's actions is to ask them what they intend to do within a reasonable time range. According to these models, a person's attitude toward performing behaviour change is influenced by behavioural intention, and by beliefs about whether persons who are important to the individual, approve or disapprove of the behaviour (*subjective norm*). The Theory of Planned Behaviour includes an additional construct, perceived behavioural control or self-efficacy. This component takes into account situations in which people's behaviour, or behavioural intention, is influenced by factors beyond their control.

Ajzen and Driver *(1991b)* argued that people might try harder to perform behaviour if they feel they have a high degree of control over it. Although this theory is helpful in detecting the determinants of certain behaviours, it does not necessarily produce a change in behaviour *(Hobbis and Sutton, 2005).* Systematic reviews of interventions based on the Theory of Planned behaviour show that they rely mostly on providing information *(Hardeman et al, 2002).* One limitation of interventions based on this theory is that they focus mostly on giving information, which alone is not sufficient to elicit behavioural change *(Hobbis and Sutton, 2005).*

2.4.2.4 The Social Cognitive Theory

Some theories of health behaviour presume individuals live within, and are influenced by a social environment. People surrounding an individual influence his or her feelings and behaviour by their opinions and thoughts, and the individual has a reciprocal effect on those people. The social environment includes family members, friends, teachers and others. The social environment affects health through its effects on behaviour. The Social Cognitive Theory is one of these theories. It is the most frequently used theory among health behaviour theories *(US Department of Health and Human Services, 2005).* The Social Cognitive Theory stemmed from the Social learning theory. Albert Bandura updated the Social Learning Theory by incorporating the notion of modelling as a form of learning, which states that people learn from observing the actions of others and by seeing the benefits of these actions *(Bandura, 1986).* He also introduced several other constructs such as self-efficacy and reciprocal determinism.

The Social Cognitive Theory includes many constructs integrated from cognitive and behaviourist models of behaviour change and these are the following *(Bandura, 1986; 1997; 2004)*:

- <u>Reciprocal determinism</u>: this construct describes the dynamic interaction between the environment, personal factors, and behaviour. However, this interaction is not equal among all sources of influence. It is based on the individual, the particular behaviour being studied, and the specific situation where the behaviour is occurring.
- <u>Behavioural capability:</u> states that, to perform a behaviour, a person must know what to do and how to do it. Knowledge should be promoted through skill mastering to perform a given behaviour.
- <u>Observational learning or modelling</u>: refers to the ability of the individual to learn from observation of others. Moreover, the observers will most likely model behaviours of people that are credible to him and those that he mostly associates with.

- Expectations: are the results an individual predicts from taking action. The degree to which behaviour is thought to produce a positive outcome influences the probability of adopting that behaviour.
- Self-efficacy: is considered by Bandura the most important personal factor in behaviour change. It is defined as the confidence in one's ability to take action and overcome obstacles. If a person feels he is capable of achieving a certain goal, than he would likely work harder to reach that goal.
- Reinforcement: Positive reinforcements or rewards increase a person's likelihood of replicating the behaviour. Reinforcements can be internal or external. Internal rewards are things people do to reward themselves. External rewards as token incentives can encourage continued involvement in multiple-session programs.

Different situations call for different theoretical frameworks; choosing a theory that suits the situation at hand can be problematic. Guidelines for selecting theories state the importance of opting for a theory that has been tested in similar populations and settings and supported by past research in the same area *(US Department of Health and Human Services, 2005).* In addition, a theory must match the unit of analysis (individuals or organisations), and be consistent with characteristics of the behaviour to be addressed. Although theories that identify determinants of behaviour change are useful, those that offer guidelines of how these determinants may be modified should be employed *(Brug et al, 2005).* Additionally, approaches that take into consideration potential determinants both internal and external to the individual should be tackled. Therefore, using concepts from different relevant theories can prove more beneficial than the use of single theory. Employing several theories in tandem may reduce the limitation of one theory and improve intervention outcomes *(Hobbis and Sutton, 2005).* Accuracy and practicality are also warranted when designing effective behavioural interventions *(Rothman, 2004).*

Hence, researchers are more in favour of behavioural theories that specify the determinants of behaviour and offer guidance on how to achieve the behavioural change, such as the Social Cognitive Theory *(Bandura, 2004).* While most health behaviour models predict health behaviour, the social cognitive theory goes a step further and offers both predictors and principles of how to change behaviour *(Bandura, 2004).* Many school-based interventions which aim to prevent childhood obesity and targeting 6-12 year old children have been underpinned by the Social Cognitive theory *(Shepherd et al, 2006, Sharma, 2006; Sahay et al, 2006)*.

Studies reporting positive outcomes found that the Social Cognitive theory was well suited for the development of intervention programmes aiming at dietary change *(Gortmaker et al, 1999; Manios et al, 2002; Warren et al, 2003; Kipping et al, 2008; Chen et al, 2010).*The key components of the Social Cognitive Theory that were used in the development of these interventions were modelling or observational learning and methods to help skill development and increased self-efficacy. Thomas *(2006)* found that interventions based on the Social Cognitive Theory proved to be efficient in many school-based interventions targeting 9-11 year old children (Gimme 5, CATCH, SPARK, Planet Health).

As The Social Cognitive Theory includes constructs that enhance the psychosocial or personal and environmental mediating variables for physical activity and dietary behaviour such as knowledge, self-efficacy, attitude, and parental involvement it was suggested as a useful theory for behaviour change interventions targeted to children aged 10-12 years.

The following section describes the different determinants identified in behaviour change interventions targeting children aged 6-11 years as predisposing factors to illicit change in nutrition related behaviours.

2.4.3 Determinants of behavioural change

Determinants of behavioural change that have been consistently identified as potential mediators or correlates of behavioural change in children include: modelling and social support, knowledge, self-efficacy and availability of food *(Cerin et al, 2009).* Culturally adapted interventions were also shown to be more effective in inducing behavioural changes in children 9-11 year old children *(Waters et al, 2011).*

2.4.3.1 Modelling: parental involvement

As discussed above, the advantages of the school setting are numerous; However, the child lives in an environment with multiple factors that could influence his eating habits and his risk of becoming overweight or obese *(Ebbeling et al, 2002)*. Some of these environments are called 'obesogenic' *(Carter &Swinburn, 2004)* which, although difficult to quantify, are environments which conspire against healthy eating and physical activity. The home setting is one of these factors. As children reach the age of transition from childhood to adolescence (10-12 years) they gain more independence with respect to their dietary and physical activity choices. However, the family environment still exerts the most influence on children's energy balance related behaviours *(Story et al, 2002).* As parents establish both the social and physical environment of their children, obesity prevention programmes must include the family as an intervention component to help in modelling, encouraging and practising the healthy behaviours.

Many programmes in schools did attempt to modify the home environment by involving families either through direct involvement or through activities the children completed with their family at home. The level of parental involvement varied from low, with parents providing consent only, medium, where parents were provided health information, and high, with parents being exposed to intervention components *(Nixon et al, 2012).*

Overall, there was agreement among authors that parental involvement had been essential to the success of the interventions. “Involving family more” is reported as one of the lessons learned by the school-based programmes Pathways and CATCH *(Luepker, 1996; Caballero et al, 2003)*, which identified that, to be successful, childhood obesity prevention programs need to address environmental and socio-economic factors that go beyond the school setting. This was one of the reasons cited by the authors in the Pathways programme to explain the lack of effect of the intervention on per cent body fat. On the other hand, the significant changes in cardiovascular disease risk factors and fitness indices resulting from the Health and Nutrition Education programme in primary school children in Crete was partly attributed to the high parental participation in the programme *(Manios et al, 2002).*

There are several other examples of successful interventions that incorporated a parental involvement component. These include: The Kiel Obesity Prevention Study, Beijing study, the HIKCUPS study, and Be a Fit Kid study.

The Kiel Obesity Prevention Study, KOPS *(Danielzik et al, 2004, 2007a)* started in 1996 by enrolling a large cohort of 5 to 7-year-old children. KOPS was an on-going 8-year follow-up study. The KOPS intervention consisted of nutrition education for all children, parents and teachers and promoted healthier lifestyle through decreasing intake of high energy foods and sedentary activities and increasing physical activity. Parents received the information during school meetings. For families with overweight and obese children and/or parents, support programmes were offered within the family environment *(Müeller et al., 2001).* A four year outcome evaluation of the KOPS showed that the programme had sustainable effects on nutritional knowledge and remission of overweight, especially in girls *(Danielzik et al., 2007b).*

A three year obesity intervention took place in five primary schools in Beijing, China *(Jiang et al., 2007)*. The programme involved parents and children and focused on nutrition education and physical activity. Parental involvement could be classified as high as parents were exposed to the intervention through lectures conducted once per semester during the routine parents meetings organised by the schools. It is true that attending one lecture per semester might be considered insufficient when involving parents with an intervention. However, compared with indirect methods of involvement, and given the difficulty in getting parents to attend meetings in schools, a lecture once per semester may be rated as high parental participation. The parents received information concerning childhood obesity prevention and the lectures focused on health consequences of childhood obesity and elements of a healthy lifestyle. Attendance rate during these meetings was high (90%). A significantly lower prevalence of overweight and obesity was found in the intervention schools compared with the control schools. The study also found that more non-obese children became obese in the control schools.

The Hunter Illawarra Kids Challenge Using Parent Support (HIKCUPS), an Australian multi-site randomised controlled trial, was conducted in overweight/obese children *(Jones et al., 2007).* This study also shows the importance of parental involvement. It compared three interventions: 1) a parent-centred dietary approach; 2) a child-centred physical activity approach; 3) a program combining both approaches. The intervention aimed at empowering parents to change usual eating habits through the use of reinforcements and incentives. It consisted of a 10-week programme with weekly group sessions, weekly homework and telephone calls following the programme. During the sessions, a combination of information, discussion and practical activities were provided to parents. They were also encouraged to role model healthy dietary habits. Children's dietary intake was assessed at baseline, at 6 and 12 months post-intervention. At both time points, there was a significant decrease in total quantity of food consumed. At 12 months, the authors observed a significant increase in the consumption of core foods – except for fruits – and a significant decrease in non-core foods consumption, with the largest decreases observed for sweetened drinks and packaged lunch box snacks.

“Be a Fit Kid” is an intervention conducted in elementary schools which was aimed at promoting a healthy lifestyle in children *(Slawta et al, 2008)*. The programme was given three times a week for a total of twelve weeks. It combined physical activity and nutrition education. Parental involvement was encouraged through an initiation lecture that covered nutrition and physical activity standards, parents were also asked to take part in the programme by reading the information sent home with their children and preparing a healthy snack towards the end of the programme. Significant improvements were observed following the 12 weeks intervention in all fitness measures. In children who showed high attendance (at least 75%), significant reductions in triglycerides and total cholesterol were observed. More than 75% of students increased their intake of healthy foods such as vegetables, fruits and whole grains, with these positive habits maintained six months following the intervention.

When looking at data on whom best to involve, mothers or fathers in obesity prevention programmes studies have shown that both should be implicated depending on the child gender. A study on gender assertive association of body mass index in healthy trio (mother, father, child) found that the risks of obesity at 8 years were 10 fold greater in girls and six fold greater in boys when the same sex parent was obese *(Perez-Pastor, et al, 2009).* Authors concluded that their findings might explain why behavioural interventions at the child level might have little impact and that parents could willingly be involved in the interest of the child.

2.4.3.2 Educational strategies to increase knowledge and self-efficacy

A classroom-based educational component is part of most school-based interventions to prevent childhood obesity. Including enjoyable and original activities in classroom sessions is a positive step towards increasing behavioural changes, mainly in nutrition and physical activity *(Speiser, 2005)*. Educating children through play-based methods seems promising compared with traditional teaching using advice or prohibition *(Bartfay and Bartfay, 1994; Corbett and Lee,1992).* Previous studies have used multimedia, interactive and board games to increase nutrition knowledge and change dietary behaviour in children *(Baranowski et al, 2003; Turnin et al, 2001).*

Intervention programmes targeting children aged 9-12 years that showed positive outcomes in weight status change, physical and dietary behaviour change and/or change in knowledge and attitude used novel and fun activities within their educational components *(Manios et al, 1999; Taylor et al, 2006; Amaro et al, 2006).*

A recent review has found that learning about the behaviour-health link through “hands-on” activities, proved to be effective in reducing body weight and adiposity in young children aged 4-6 years old, improving physical activity and dietary behaviours as well as determinants of lifestyle behaviours such as health knowledge and attitudes to health. Interactive sessions with students, teachers and parents were viewed as occasions for skill development *(Nixon et al, 2012).*

Examples of studies that used hands-on, fun and novel activities are described below.

The APPLE project was a two year community, school-based intervention that developed approaches to prevent obesity in 5-12 year old children *(Taylor et al., 2006; Taylor et al., 2008).* Unlike previous school-based interventions that targeted behavioural changes by curriculum initiatives, APPLE focused on developing original and fun activities during non-curricular times. As it used activity coordinators, this project had the advantage of reducing the workload for teachers. It introduced activities such as golf, taekwondo and community walks, and combined these activities with simple messages to promote healthy eating. Significant reduction in the rate of excessive weight gain was observed in children in intervention groups compared with controls, although this may have been limited to the ones who were not initially overweight. This reduction was very much enhanced at 2 years *(Taylor et al., 2006; Taylor et al., 2008).*

In the Cretan study *(Manios et al, 2002),* work books and teaching aids were developed specially for the intervention, and modules were designed to increase behavioural capability and self-efficacy for healthful eating and physical activity. Parents also attended meetings presenting relevant messages for better dietary and physical activity behaviours and were encouraged to change their own and their children's.

Innovative interventions to prevent overweight and obesity in school children have also been tested. In Italy, Kalèdo, an educational board game was used to teach children about nutrition and to influence their dietary intakes *(Amaro et al., 2006)*. The programme resulted in a positive output as the authors observed a significant increase in nutrition knowledge and in the children's vegetable intake compared with controls. Although more research is needed on the long-term effects of this study, the results of this trial indicate that during childhood and adolescence, games such as Kalèdo can be useful in bringing about dietary changes. In this age bracket, gaming can be an efficient tool to achieve dietary behaviour changes *(Cullen et al, 2005).*

Other studies included interactive sessions with the aim of improving skill development in food preparation and cooking *(Adams et al, 2009)*. Parents and children were also encouraged to taste foods prepared during the activity sessions, and the children were offered the chance to grow their own vegetables. The mean combined number of fruit and vegetable servings in lunch boxes increased significantly in the intervention group compared with controls.

Another novel theatre-based, after-school obesity prevention programme was implemented in the United States to reach children and parents from low-income neighbourhoods *(Neumark-Stainer et al., 2008).* Although the pre/post results indicated that both parents and children had or intended to make some positive behavioural changes, no significant differences were found at follow-up. The authors concluded that although this programme increases awareness in ethnically diverse and hard-to-reach families, it needs to be integrated in a more comprehensive obesity prevention programme, given the complexity of behavioural change.

Involving children and their parents in cooking classes was also shown to be effective on some mediators of behavioural change. In 2008, Petits-Cuistots – parents en réseaux, *(Bisset et al., 2008)* a school-based nutrition intervention, took place in elementary schools located in low-income neighbourhoods in Montreal, Canada. The “Little Cooks” component offered nutrition and cooking workshops and the “Parental Networks” component invited parents to get involved with the programme’s activities. The intervention had some impact on knowledge of the foods’ nutrient content, food produce and cooking as well as perceived cooking capacity. The study showed a greater participation in school activities of families with students participating in the programme.

2.4.3.3 Culturally sensitive programmes

As cited previously, reviews have suggested that weight management interventions can be effective when designed to target several overweight related health behaviours, and involve parents and include interactive learning. Furthermore, interventions developed to be culturally appropriate have proved to be effective when dealing with different ethnic groups and with minorities and economically disadvantaged children *(Summerbell et al, 2003; Enderlin and Richards, 2006; Stice et al, 2006).*

The child-centred and family-focused behavioural programme, Active Balance Childhood (ABC) study*, (Chen et al, 2010),* was a randomised controlled study of a culturally sensitive behaviour intervention. The study focused on promoting healthy weight management and healthy lifestyles; adequate dietary intake and improved physical activity, in Chinese American children, aged 8-10 and their families. The intervention programme consisted of educational play based activities to increase the students' self-efficacy and skills related to nutrition and physical activity. The children took part in a play-based workshop facilitated by a bicultural/bilingual research assistant. In addition, an interactive dietary preparation software programme, tailored to common Chinese foods was developed. The students also received a packet of materials in both Chinese and English highlighting activities that promote healthy eating and physical activity. In addition, parents attended hands-on workshops led by a bicultural/bilingual registered dietician. The results showed that the intervention significantly decreased BMI, diastolic blood pressure and fat intake of students, while increasing fruit and vegetable intake, actual physical activity and knowledge about physical activity in intervention children compared with controls.

The multisite school-based study, Pathways, was also a culturally appropriate school intervention *(Davis et al, 2003).* The classroom curricula incorporated culturally appropriate lessons through the use of tribal knowledge, maps of Pathways Nations and American Indian stories. Students' interest was enhanced by the use of American Indian flute music signalling the start of the activity. The lessons focused on the importance of living a healthy life, a widely held American Indian value. The story of two school children living in an American Indian community and young American Indian runners was also depicted in the curricular lessons with special emphasis on cultural pride and healthy traditions. The American Indians on the study committees and working groups provided essential guidance and input throughout the study. According to authors, one of the important outcomes of Pathways is a culturally appropriate health promotion and disease prevention curricula designed specifically for American Indians that is effective. This culturally appropriate intervention produced positive significant changes in food-and health-related knowledge and behaviours as well as in cultural identity *(Caballero et al, 2003).*

The child-centred education programme Salsa, Sabor y Salud, *(Huang et al, 2008)*, was developed for Latino families at three pilot programmes in Los Angeles and Chicago. The study employed a health centred, culturally relevant nutrition education programme to help students develop healthy eating habits, make physical activity part of their daily lives and be encouraged to advocate those habits in their schools and families. The inclusion of culture-based activities was interesting to students. According to the programme staff members, the children liked the activities because it came from their culture and they played it with their mothers. The programme made a positive impact in students' healthy behaviours. Positive results were also seen in the knowledge and healthy behaviours of the instructors. Furthermore, the Salsa, Sabor y Salud messages reached parents through their children, as they shared their knowledge and encouraged their families to adopt healthier lifestyles.

The authors concluded that an accessible and convenient culturally appropriate intervention can be effective in preventing overweight and improving cardiovascular health in a high risk population *(Caballero et al, 2003; Chen et al, 2010)*

In conclusion the review of the literature suggested that multicomponent interventions to prevent obesity in school children aged 9-11 years should incorporate the following strategies and approaches in addition to the previous components presented earlier:

- The use of a theoretical framework, such as the Social Cognitive Theory.
- High levels of parental involvement.
- Interactive school-based learning.
- Culturally appropriate programmes.

2.5 Summary of the evidence that informed the methods of the present research

Based on the research reviewed above, it was evident that the prevalence of childhood obesity is global and is touching many low and middle-income countries including Lebanon. Studies have shown that overweight increased by 8% in Lebanese boys and girls over a period of 12 years, and obesity almost doubled *(Nasreddine et al, 2012c).* Recent studies suggested that in Lebanon persistent childhood obesity is established before age 11 years *(Akl, 2012).* On the other hand, Lebanese children suffered from poor eating habits as they hit adolescence, such as skipping breakfast, low intake of fruits and vegetables in addition to increased consumption of high energy foods and beverages *(WHO, 2005).* Furthermore, it was found that skipping breakfast, frequency of consumption of fried foods, chocolate and eating out and decreased physical activity were associated with overweight and obesity in Lebanese children aged 9-11 years *(Nasreddine et al, 2012a, Chacar and Salameh, 2011; Fazah et al, 2010).*

Therefore, children in the transition from childhood to adolescence can be considered at an ideal age at which to intervene for obesity prevention programmes. Certain lifestyle behaviours were identified as causes of the childhood obesity epidemic *(Hill et al, 2003)*. Modifiable behaviours that can influence energy balance should therefore be targeted when designing childhood obesity prevention programmes. These include dietary, physical activity and sedentary behaviours. Evidence also showed that school is considered a convenient setting for conducting interventions to prevent childhood obesity.

The present study will test the effectiveness of a multicomponent school-based intervention combining healthy eating and physical activity. Reviews suggested that interventions aimed at changing dietary behaviour in youth should target self-efficacy, habit and outcome expectations which are key constructs of the Social Cognitive Theory *(Cerin et al, 2009)*. Therefore, the programme will be underpinned by the Social Cognitive Theory and will use interactive learning and be culturally sensitive as evidence showed that these strategies were among factors included in successful interventions *(Summerbell et al, 2008).* The intervention will also involve the wider children's environment by including the family and the school environments and will focus on the following energy based related behaviours: breakfast skipping, sweetened drinks consumption, energy dense snacks intake, sedentary and physical activities.

The intervention will have a duration of 12 weeks since reviews recommended this as a minimum duration when assessing the efficacy of pilot controlled trials *(Summerbell et al, 2008).*

Given the pilot nature of this study, the researcher will be delivering the intervention herself with the help of one assistant researcher, to be able to test the efficacy of the intervention under ideal circumstances. The intervention will be delivered exactly as designed with adequate resources and time to deliver it. This will also give more insights on field barriers that might be encountered during programme implementation. A plan for sustainability will be proposed at the end of the thesis.

Chapter three: Methodology

This chapter presents details on the methodology used in the current study which was based on a mixed method approach. The main philosophical paradigms are detailed in the following sections with special emphasis on mixed methods as this is the paradigm applied in the present research. Justification for the choice of this theoretical paradigm as well as the research framework used to guide the study is also presented.

3.1 Overview of research paradigms

Research frameworks vary from wide-ranging to very specific theoretical approaches. Paradigms are broad theoretical frameworks that offer researchers with a cohesive set of concepts, and principles and rules for conducting research. A paradigm is defined as a worldview that gives a description of the social world linked to connected sources of information and suitable methods to use these sources *(Guba and Lincoln, 1994).* It can be a strong strategic tool that guides the decisions that arise when planning, designing and implementing a research project.

Two major paradigms most commonly used in public health research are the positivism, based on a largely quantitative assumption, and interpretivism, based on a mostly qualitative assumption *(Ulin et al., 2005).* A pragmatic assumption can also be used, which incorporates important elements from each paradigm in carefully designed studies. Today, many researchers choose mixed methods over one sided paradigm adherence. The following sections in this chapter describe these theoretical paradigms, and their different strengths and limitations when applied to health research.

3.1.1 The positivist view or quantitative research

To many food and nutrition professionals the term research draws ideas of numbers, measurement, controlled environments, randomised controlled trials, interventions and outcomes. Epistemologists refer to this as quantitative research *(Carter and Little, 2007).* Much of what is known today about public health can be credited to research that has developed from quantitative methods in the natural sciences. This framework has progressed from a philosophical approach called positivism. This methodology explores facts and causes of human behaviour through objective, observable and quantifiable data *(Ulin et al, 2005).* Quantitative studies use standardised tools, and research subjects are considered passive/reactive organisms, similar to basic matter in hard sciences *(Duffy, 1987).* As for the quantitative researcher, he is viewed as an objective scientist whose major duties are to work on the environment and observe the effects on the subjects *(Stainback and Stainback, 1984).*

Quantitative research also involves experimental and quasi-experimental designs that rely on control and randomization, in order to reduce various forms of bias and thus increase one's confidence in the results of such studies. Bias is a major issue in practically any quantitative study; it is defined as an error that can occur during the design, the conduct or analysis of the research that can lead to an erroneous estimation of the outcomes of a the study *(Gordis, 2000).* The various forms of bias include selection and information bias. There also exist several types of information bias that might result during interviewing, from surrogate interviews, recall and reporting. Biases need to be assessed and when possible eliminated through randomisation and proper selection of data collection tools *(Gordis, 2000).*

Control is essential to quantitative research since it separates irrelevant variables and focuses on the associations that were emphasised in the research question. Randomisation helps the researcher spread evenly the effect of appropriate variables. Accuracy, reliability and minimising bias are significant criteria when evaluating the quality of findings *(Ulin et al, 2005).*

Over the years, quantitative scientists such as demographers, epidemiologists, and biostatisticians have gone through many challenges to answer difficult questions in public health. Their efforts have resulted in a remarkable amount of knowledge about public health. Still, many questions remain unanswered, such as understanding behaviour change, and what enables some people to make healthy changes, whilst others fail. Consequently, researchers often look for other ways of studying human behaviour, i.e. from different perspectives or paradigms, namely in methods of qualitative research *(Tashakkori & Teddlie, 2003).*

<u>Tools used for data collection in quantitative research</u>

Nutritional surveys or questionnaires have been widely used in large-scale intervention studies to assess dietary and physical activity habits and their determinants *(Gortmaker et al, 1999; Manios et al, 1999; Caballero et al, 2003; Eisenmann et al, 2003).* Using questionnaires as assessment tools is considered inexpensive and time and effort efficient *(Burns, 2000).* Studies also showed that participants usually accept this method of assessment *(Kohl et al, 2000).*

Several tools exist for the assessment of dietary habits in large populations. Reviews have considered the strengths and limitations of these tools in assessing diets of children and adolescents *(Rockett and Colditz, 1995, 1997b; Rocket et al, 2003)*. The main methods that are commonly used are dietary records, 24-hour dietary recalls and food frequency questionnaires. Each has its advantages and disadvantages when applied in childhood.

The food records give written accounts of food and drink intake during a specific time, usually 3 or 7 days *(Livingston et al, 2004).* They provide both quantitative and qualitative data and the number of days required to estimate usual intake depends on the type of nutrient measured. This tool is considered a good standard as it does not rely on memory and provides a reasonable estimate of an individual intake. However, weighed records are expensive and effort demanding for both participant and researcher. It can be used for older children (older than 10 years) with a good level of literacy and legible handwriting. Knowledge of names of brands and products is also a must.

Food recalls are structured interviews where a professional interviewer asks a participant to recall his food and drink intake during the last 24 hours or three days *(Livingston and Robson, 2000).* This tool causes minimal burden to participant, but it depends on memory and could be time consuming. The use of such tool with children should take care of overestimation of energy intake with children younger than 9 years. Mothers have shown to be accurate informants of their young children's intake.

Food frequency questionnaires report individual's frequency of consumption of a food from a list of foods for a specific time, usually one month but could be six or twelve *(Cade et al, 2004).* The food frequency questionnaire does not collect details on methods of cooking and has minimal information regarding portion size, therefore it describes the usual food intake but the quantification is not considered very accurate. Children have to be at least 9 years old to be able to grasp a food frequency questionnaire.

It has been shown that there is no consensus regarding the best method of assessing dietary intake in children and adolescents; many factors should be taken into account when selecting an assessment tool mainly the literacy level and age of the children as well as their cognitive ability and motivation *(Rocket et al, 2003)*. When assessing dietary habits of children it was not clear to what extent the age of the child and his cognition and social background affected the outcomes of the assessment.

Factors that mostly affected dietary intake in children were: age, food habits, cognition, portion size estimation and weight status *(Collins et al, 2010).*

Studies have shown that children younger than 12 years are more willing and enthusiastic when asked to report their food intake *(Goodwin et al, 2001).* On the other hand, even though adolescents are more capable in recording their food consumption, they are usually less interested and less motivated as they find the task tiresome and irritating *(Livingston et al, 1992)*. Generally speaking, children aged 9 years and greater are capable of self-reporting their food intake, however, children younger than 8 years need adult assistance to accurately provide dietary information *(Livingston et al, 2004).*

Adults usually control children's food environment by deciding the food offered as well as timing and frequency of eating occasions. Children's food habits change as they get older. Adolescence is characterised by less structured food habits compared to childhood. When children reach adolescence they spend more time outside home and consume more meals in restaurants. This makes it difficult for adolescents to accurately remember food items and quantities consumed *(Livingston and Robson, 2000)*.

Reporting of dietary intake in childhood is also affected by several cognitive factors: low literacy skills and attention span, limited knowledge in food and food preparation methods. Memory and concept of time were also found as limiting cognitive factors in children when recalling food intake *(McPherson et al, 2000)*. Given that portion size estimation has been shown to be problematic in adults, studies in children have shown that this is even more difficult in children and generate greater errors than adults *(Cullen et al, 1998; Lytle et al, 1993)*. Underestimation and overestimation of portion sizes were found to vary between 50 to 100% in children when compared to the actual portion size *(Frobisher and Maxwell, 2003)*. Validity of portion size estimation improves with age;

tools such as photos, food models and software have also shown to increase validity of portion estimates in children *(Foster et al, 2006; Foster et al, 2008).*

As with dietary assessments, self-report methods for the assessment of physical activity among children and adolescents have been most frequently used *(Kohl et al, 2000).* Instruments included recall of physical activity ranging from one day to a year and were either self-administered or conducted by an interviewer. Reviews suggested low to moderate validity for the self-reported methods and recommendations are not in favour of their use with children younger than 10 years *(Kohl et al, 2000).*

While measurement of physical activity in children has gained much attention and experienced the use of objective monitoring, the same did not occur with inactivity or sedentary behaviour assessments in children *(Bryant et al, 2007).* As with dietary and physical activity behaviour assessments, self-report measures of sedentary activities are commonly used. Time spent watching television has been the focus of sedentary behaviour studies, other sitting habits such as using the computer, playing electronic games, reading, talking on the phone and methods of commuting have been also examined *(Marshall et al, 2004)*. Studies reviewing measurement of television viewing among children and adolescents found that most of the surveys were self-administered and few used an interviewer *(Bryant et al, 2007)*. Surveys included studies exclusively measuring TV watching, others incorporated the measurement of sedentary behaviours within a physical activity survey and many assessed television viewing using a single item as a minor part of a multi-component survey *(Bryant et al, 2007).* Only some studies measured the validity and reliability of the tools used; those that were evaluated were compared to another self-report measure or used an objective measure of physical activity or psychometric data.

Few studies measured television viewing through direct observation; however, recruitment of participants was low, especially when in-home observations were measured. Authors noted that this could be suggestive of the disturbing nature of direct observations. Recommendations were to select measurement tools that are methodologically feasible and have psychometric data to support their validity and reliability *(Bryant et al, 2007).*

In the present research, many factors affected data collection, of which time constraints (the school allocated one class hour for questionnaire completion, and the recess for anthropometric measurements), and age of the child. Therefore, when deciding on which type of tool to use for data collection, the research team had to develop one that covers all aspect of the intervention (dietary, PA and sedentary habits, knowledge, self-efficacy, beliefs) and take into account the time limitation and age of the children.

3.1.2 The interpretivist view or qualitative research

The theoretical framework for most qualitative research stems from an interpretivist view, a paradigm that looks at the world from people's experiences and interactions with each other, and the wider social context *(Tashakkori &Teddlie, 2003).*

Qualitative research involves a holistic approach, where the researchers look at the events in regard to social, cultural and physical environments of the people they are studying. It is also defined as a naturalistic approach that seeks to understand phenomena in an uncontrolled, context specific, setting *(Neutens & Rubinson, 2002).* Qualitative research generates results not derived from standard statistical procedures. The researcher is the measuring instrument, and words, sounds and pictures are the data elements *(Hoepfl, 1997).* The type of research questions that define a qualitative study are mainly those that address why, how, and under what circumstances, rather than which and how many.

In qualitative research, meanings and participant perceptions are of great value. For example, a qualitative researcher is not necessarily interested whether research education is offered in dietetics education programmes, but rather how programme directors perceive this subject area, as well as barriers and facilitators to its implementation *(Harris et al, 2009).* Participants are encouraged to speak freely and express their insights and experience into a given phenomenon.

Table 3.1 summarizes the different characteristics of quantitative and qualitative research.

Table 3.1 - Characteristics of qualitative and quantitative research

	Quantitative or positivist research approach	**Qualitative or interpretivist research approach**
Basic assumption	Deductive: a single objective reality that can be measured, independent of the researcher	Inductive: Subjective multiple realities, seen from different perspectives and cannot be predicted or controlled
Study	Testing of hypothesis	Development of hypothesis
Setting	Controlled	Naturalistic, natural day to day environment
Subjects	Large number of subjects	Smaller number of participants
Methods of data collection	Standardized and numerical	Textual, audio and visual
Basic elements and methods of analysis	Numbers and statistical analysis	Words, narrative, using content and thematic analysis
Outcomes/ findings	Explored due to treatments and manipulation. Findings can be generalised	Explore reasons to outcomes, matters and interactions between humans. Findings cannot be generalised beyond the study sample.

Adapted from: Harris et al, 2009.

3.1.3 The Mixed Methods research

Recently, a perspective has been offered that considers quantitative and qualitative research to be complementary *(Medlinger and Cwikel, 2008).* Researchers have realised the benefits of using more than one theoretical perspective to study a problem or question. Creswell and his colleagues *(Creswell et al, 2003),* defined the mixed method approach as research that involves the collection and analysis of both quantitative and qualitative data in a single study. Data can be collected concurrently or sequentially and are given a priority. Integration of data is done at one or more stages in the process of research.

Epistemologists have supported the use of Mixed-Methods research in an effort to achieve greater reliability and validity. Reports have shown that combining qualitative and quantitative strategies in a single study can result in a more powerful design than either one used alone *(Tashakkorie and Teddlie, 2003; Knodel, 1997).* The weakness in one can be balanced by the strength of the other and vice versa. In fact, they can be used in concert to achieve a complete picture of the phenomenon *(Neutens and Rubinson, 2002).*

This PhD thesis involves the use of a Mixed-Method approach, which allowed answering a research question involving the acceptability and effectiveness of an intervention among school children and their parents. It aimed to help gain insights on some limiting aspects of intervention effectiveness which a quantitative approach alone could not achieve. In the following sections the purposes and designs of a Mixed Methods research are discussed in more detail.

3.1.4 Purposes of Mixed Methods research

Several justifications have been suggested to define the purpose for Mixed-Methods research. Greene et al *(1989)* described five purposes, which are outlined in Table 3.2.

<u>Table 3.2</u> Greene's purposes for Mixed Methods Research

1	**Triangulation**	Or corroboration of findings across different methods, i.e. between quantitative and qualitative data
2	**Complementarity**	One method enhancing or clarifying specific results of the other
3	**Development**	Using results from one method to assist in the development of methods for the other
4	**Initiation**	Highlighting conflicting findings and paradoxes by contrasting the results from one method with the other
5	**Expansion**	Extending the breadth of a study. Qualitative research might follow quantitative research to investigate with greater vigour a phenomenon once a problem is identified by quantitative study

An advantage of the scheme proposed by Greene et al (1989) is its simplicity. In their review of early Mixed Methods studies, they stated that the most frequent purpose for the use of Mixed Methods research was complementarity (45%) and expansion (31%); development, triangulation and initiation were less common. A disadvantage is that not all Mixed Methods research can be classified into these five purposes. Accordingly, a more detailed and comprehensive scheme was developed by Bryman *(2006).* It was based on a wide review of the types of reasons that are often given in research articles for combining quantitative and qualitative research. Table 3.3 summarises the different rationales for this scheme.

Table 3.3 Bryman's categories for the uses of Mixed Methods research

1	**Triangulation**	Refers to the traditional view that quantitative and qualitative research might be combined to triangulate findings in order to enhance validity
2	**Offset**	Combining quantitative and qualitative research to allow the researcher to offset the weaknesses and to draw on the strengths of both
3	**Completeness**	When both quantitative and qualitative research are employed the researcher can convey a more comprehensive investigation of the topic of research in which he is interested
4	**Process**	Quantitative research provides a description of structures in social life, but qualitative research provides sense of process
5	**Different research questions**	Qualitative and quantitative research can each answer a different research question
6	**Explanation**	One type of research used to explain the findings of the other
7	**Unexpected results**	When unexpected results are generated by a research method and can be understood by the other
8	**Instrument development**	When qualitative research is used to develop more comprehensive questionnaires and tools for quantitative research
9	**Sampling**	One approach is used to facilitate the sampling of respondents of the other
10	**Credibility**	Employing both approaches increases the integrity of the findings
11	**Context**	When qualitative research provides context for understanding of quantitative results from a broader survey
12	**Illustration**	The use of qualitative data to illustrate the findings of quantitative findings
13	**Utility**	A suggestion that implies that the use of the two approaches will be more useful to researchers, especially to improve the value of findings
14	**Confirm and discover**	The use of qualitative data to make hypothesis and quantitative data to test them within a single study
15	**Diversity of views**	Entails the use of quantitative and qualitative approach to combine two different views, specifically the researcher's and the participants. Quantitative research exposes relationships between variables, and qualitative research reveals implications among research participants
16	**Enhancement**	Involves enlarging either one research by using data from the other type of study

Although this classification includes a larger number of categories, there are clearly similarities with the Greene et al *(1989)* scheme. When examining the studies which were considered when developing the more detailed scheme proposed by Bryman (2006), one third of all articles used ‘Enhancement’ as a rationale for the mixed method approach; a large number also used ‘Completeness’. ‘Enhancement’ corresponds to ‘Expansion’ in Greene et al typology *(1989),* thus confirming the importance of enhancement or expansion when using mixed methods.

3.1.5 Mixed Methods study designs

Combining very different approaches in a sound design for a research study is often problematic. Much has been written in support of mixed methods as well as on the techniques to combine them. One of these techniques is the priority-sequence model *(Ulin et al, 2005)* and it is based on several criteria of which are: the implementation of data collection which involves the sequence used to collect both quantitative and qualitative data, the priority given to an approach and the stage of integration of the approaches.

This model corresponds to six basic designs in which priority and sequence are assigned to each approach. Priority is given to either the qualitative or quantitative approach, and the complementary method can precede or be a follow up to the primary method, or both can be equally important. The six types of design can be outlined as follows *(Creswell et al, 2003; Ulin et al, 2005)*:

1. <u>Sequential explanatory:</u>

   A primarily quantitative study with a matching qualitative study as follow up.

   In this design qualitative research helps interpret the results of a quantitative study. It explores with greater power a phenomenon once a problem is identified by quantitative research. Priority is given to quantitative methods but could also be equal. Stage of integration of both methods is at the interpretation phase.

2. Sequential exploratory:

   A primarily qualitative study with a matching quantitative study as follow up.

   Priority is given to qualitative methods but could also be equal. Stage of integration of both methods is at the interpretation phase.

3. Sequential transformative:

   Either quantitative followed by qualitative study or qualitative followed by quantitative study.

   Quantitative results from surveys might emphasise important concerns that could be explored in depth through qualitative research. Or quantitative follow up studies help in testing the degree to which qualitative results can be generalized to a wider population. Priority is given to either quantitative or qualitative or equal. Stage of integration of both methods is at the interpretation phase.

4. Concurrent triangulation

   Concurrent collection of quantitative and qualitative data. Priority is equal between both quantitative and qualitative method. Stage of integration of both methods is at the interpretation phase or analysis phase.

5. Concurrent nested

   Concurrent collection of quantitative and qualitative data. Priority is either given to quantitative or qualitative method. Stage of integration of both methods is at the analysis phase.

6. Concurrent transformative

   Concurrent collection of quantitative and qualitative data. Priority is given to either quantitative or qualitative or equal. Stage of integration of both methods is usually at the analysis phase but could also be during interpretation phase.

The present study was based on the sequential explanatory design and it is explained in more details in the following sections.

3.2 Justification and design sequence of the current study

3.2.1 Justification for the use of the mixed methods approach in the present study

The main purpose of the study was to identify if a school based intervention is effective in changing the dietary and physical activity behaviours of 9-11 year old children. However, since it was an exploratory study, gaining in-depth information concerning other aspects was essential to extend or enhance the scope of the research. Therefore, the mixed method approach was well indicated for use in the current study.

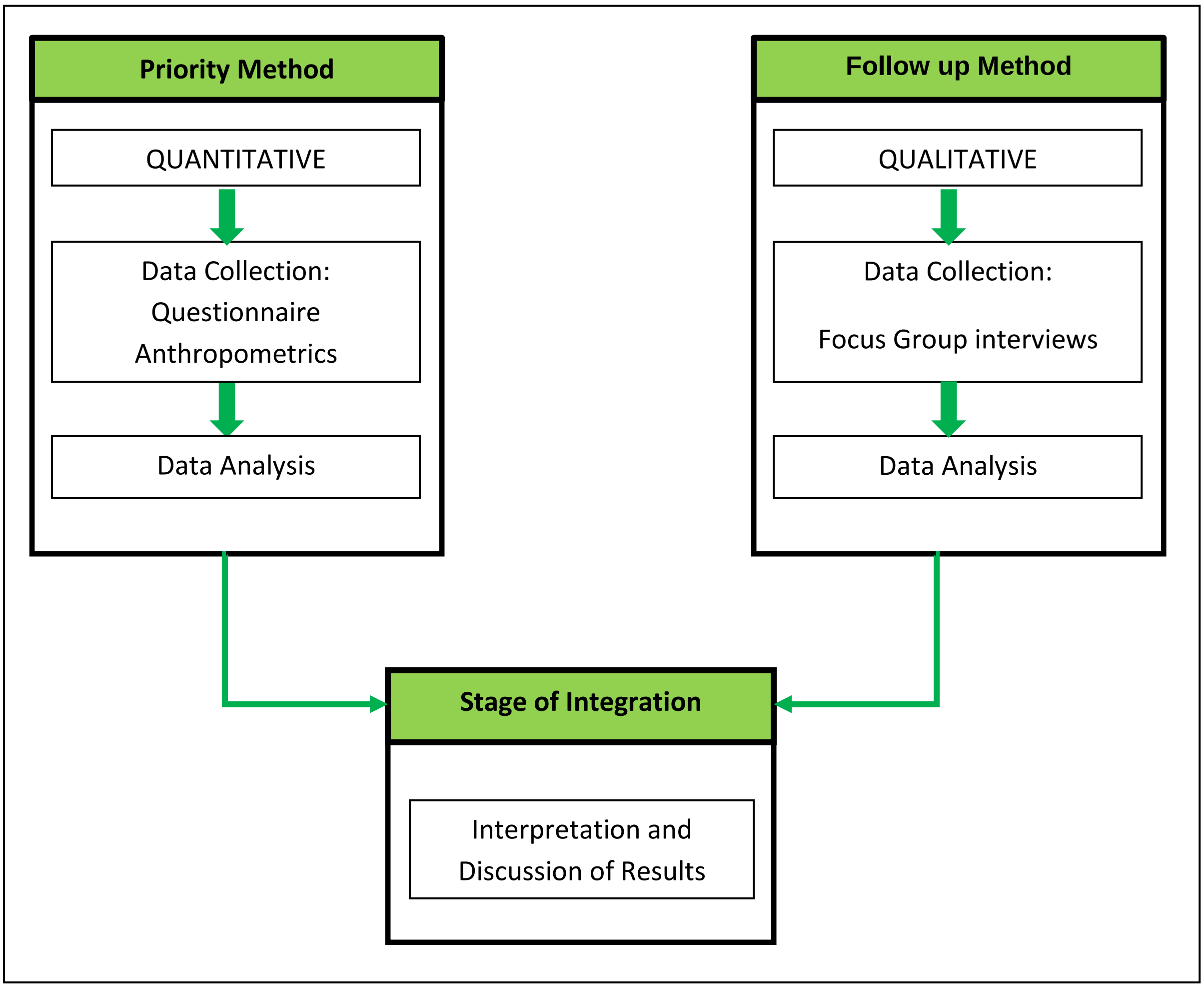
The design included a principally quantitative research with a complementary qualitative follow up study. The quantitative part consisted of a questionnaire that was used to evaluate the effectiveness of the intervention on dietary and physical activity behaviour change and determinants of behavioural change. The qualitative part included focus group interviews conducted with a sample of students, their parents and teachers to obtain their perceptions in order to evaluate the overall intervention’s acceptability and limitations and assess programme procedures.

3.2.2 Design Sequence of the present study

As discussed previously, the study was based on a sequential explanatory mixed method study design. The quantitative and qualitative data were collected separately; with the quantitative part preceding the qualitative. The integration of both methods will be at the interpretation phase within the discussion chapter of this thesis.

Figure 3.1 illustrates the design of the research project conducted.

Figure 3.1: Design and Implementation Sequence of the Mixed Method approach in the current research



3.2.3 The framework underpinning the present research

The present research was underpinned by the Medical Research Council (MRC) framework for development and evaluation of complex interventions to improve health. The MRC framework provides a sequential series of phases that help the researcher in the evaluation process of a complex intervention. The main elements of the process as described by the new guidance on developing and evaluating complex interventions are the following *(MRC, 2007):*

1- Developing a complex intervention

This phase includes identifying the existing evidence base upon which the researcher can build to be able to discern the kind of intervention needed and its study design. This is followed by identifying the appropriate theory that should be relevant to the types of changes expected to be achieved. Modelling the process and outcomes can be helpful in giving information about the design of the intervention and its evaluation. This can be a pre-trial economic evaluation or computer simulation.

2- Piloting and feasibility

Piloting of an intervention is necessary prior to proceeding to a definitive randomised controlled trial. This stage is needed to estimate acceptability, compliance, delivery of the intervention, recruitment and retention of the subjects. A combination of quantitative and qualitative methods might be required to get further insights for example on barriers to participation or implementation of the intervention. Refining the design of the study might be further needed, depending on the results obtained, before going through a large scale evaluation.

3- Evaluating the intervention

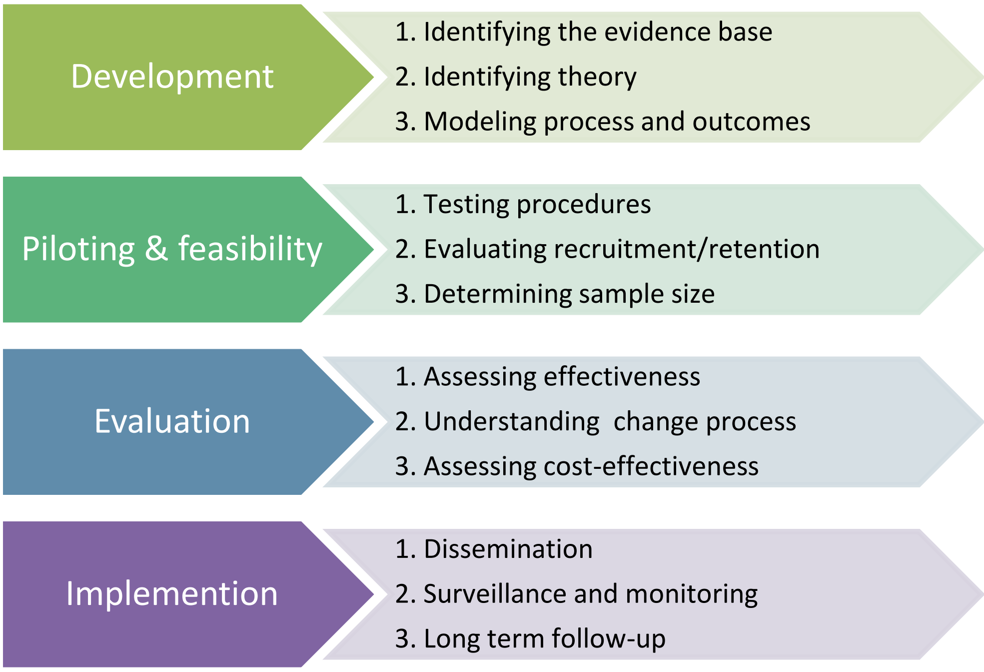
Evaluating a complex intervention can be achieved through many study designs. Whenever possible, randomisation must be considered when assessing effectiveness of an intervention, as it is the strongest scheme to prevent several forms of bias. Experimental designs for evaluating complex interventions include individually randomised trials, cluster randomised trials, stepped wedge designs, preference trials and randomised consent designs. Assessing success or failure of an intervention as well as fidelity and quality of intervention through process evaluation is greatly valuable. Finally, assessing cost-effectiveness through an economic evaluation should be included whenever possible to justify the cost of the study by the possible benefits generated from the intervention.

4- Implementation and reporting

Reporting properly an evaluation is necessary through publications in the research literature. Implementing findings into practice or policy can be achieved using accessible methods that would convince decision-makers. Furthermore, for an implementation to be successful it should be able to change population's behaviours. Many factors are involved in this process such as the scientific understanding of the behaviours that need to change, the barriers and facilitators to change. Finally, surveillance and monitoring of long term outcomes should be carried out to identify any possible unfavourable effects not observed in the original evaluation and to measure whether the effects are sustained during regular implementation.

Figure 3.2 summarises the major phases of the MRC framework that provide guidance for researchers when developing and evaluating randomised controlled trials.

Figure 3.2 Summary of the major elements of the MRC framework



Adapted from: MRC, Medical Research Council, 2007

Having identified the philosophical paradigm that was used in the present research and the framework guiding it, the next chapter describes the tools and techniques used in data collection and analysis in the present study.

Chapter four: Methods

This chapter describes the methods used in the present research. The study design, site and population are presented followed by the development of the intervention. The choice of the outcomes is then described with separate sections detailing quantitative and qualitative data collection, and analysis and process outcomes. The chapter concludes with the ethical considerations and research funding.

4.1 Study design

Further to the discussion in chapter three, the current study involves the use of a Mixed Method approach combining quantitative and qualitative research methodologies. It consists of three phases: a quantitative phase followed by a qualitative phase and the integration of both methods will be at the interpretation phase as described in chapter three.

The study is guided by the MRC framework for developing and evaluating complex interventions *(MRC, 2007).* Lebanon is a developing country and peer reviewed research is still scarce, especially research involving youth. The thorough evaluation of the existing evidence, based on international systematic reviews and the few local cross-sectional studies, constituted the first phase in best practice as outlined by the MRC framework. Departing from this point the present study is then positioned within the second phase of the MRC guidelines; whereby an intervention is developed and piloted to explore feasibility before proceeding to a definitive randomised controlled trial.

The development phase suggested that childhood obesity in Lebanon is increasing at a dangerous pace, and that Lebanese youth’s eating and physical activity habits are closely associated with increased weight.

Therefore, the current project involved the development of an intervention based on the constructs of the Social Cognitive Theory, and pilot tested using a randomised controlled trial conducted on a sample of students in selected primary schools in Beirut. The purpose of the trial was to assess the design of the study, test the efficacy of the intervention and explore the acceptability of the programme among Lebanese school children, their parents and teachers. The results of the current research will be used to plan a large scale randomised controlled trial that can be rolled out nationally and regionally in order to prevent the ramping childhood obesity epidemic in the region.

4.2 Study site

The study was conducted in Beirut, capital of Lebanon. Beirut is the largest city in Lebanon with the highest population density in the nation (21.9 persons per square kilometre). The last population census conducted in Lebanon was held in 1932, and the National Survey of Household Living Conditions estimated the Lebanese population to approximately 3.7 million in 2004 with half of the population, nearly 2 million living in the capital Beirut and Mount Lebanon *(Ministry of Social Affairs, 2008).*

Beirut is considered a cosmopolitan city comprised of a melange of all the ethnic and religious sects that make up the Lebanese population. Contrary to other governorates where one major religious sect predominates, Beirut encompasses the major ethnic and religious sects in Lebanon: Muslim Sunni and Shiite, Christian Catholics, Orthodox and Protestants, as well as minorities such as Armenians and Kurds. East Beirut is almost all Christian, while west Beirut is predominantly Muslim.

What also makes Beirut unique is the mixture of cultures combining European, mainly French, Anglo-Saxons and Arab culture backgrounds. This multi ethnic existence in Beirut enriches the society with different culinary habits, products and lifestyles.

The prevalence of childhood obesity in the capital Beirut has been shown to be the highest in the nation *(Nasreddine et al, 2012b).* This has made Beirut city an area of particular interest for research on childhood obesity. Given the highest population concentration and the representation of the various religious and socio-demographic societies living in Lebanon, the city of Beirut was considered a good choice for conducting the current research.

The present study was conducted in primary private and public schools in Beirut. The intervention, the quantitative and the qualitative assessments were all completed within the school setting.

4.3 Study population

The population targeted for this study covered children aged 9 to 11 years, the transition age to adolescence. The school enrolment rate at the elementary level in Lebanon, for both males and females is very high. The National Survey of Household Living Conditions *(Ministry of Social Affairs, 2008)* showed that school enrolment reached 98% for children aged 5-9 years, and 95% for children aged 10-14 years in 2007. This proportion declined to 70% for the age group 15-19 years. The International Poverty Centre *(Laithy et al, 2008)* survey states that poverty correlates directly with school participation. The gap between poor and non-poor in enrolment rates widen from elementary to intermediate to secondary education. The 5% decline in school enrolment for the 10/14 aged children is due to the age-grade delay for children that face academic difficulties that leads to school drop outs. Many of these children join family businesses or pursue non-skilled professions due to the economic constraints.

The Socioeconomic status of Beirut residents is divided as follows *(United Nations Development Programme, 2000)*: High Income: 8.8, Middle Income: 29.3%, Low income 61.9% amongst which 10.4% is in poverty. Given that the educational system is either public or private, high, middle and some low Income households send their children to private schools that charge high annual tuition fees. Public schools serve low income and poor families and have nominal fees.

The Lebanese Ministry of Higher Education is the official authority responsible for managing public schools. Private schools have their own independent management. Statistics from the Ministry of Higher Education *(Ministry of Higher Education, 2010)* revealed that 47% of Lebanese students attend public schools compared to 53% attending private schools. In Beirut the proportion of Private schools vs. Public schools is 54% (n=103) and 46% (n=88) respectively, matching the national distribution.

For this research both public and private schools in Beirut were approached through the Ministry of Education. Several visits were scheduled with the Ministry officials to select the study sample. A careful selection of schools was adopted by the research team and the Ministry of Higher Education to properly represent the complex demographics of Lebanon, the various socioeconomic income levels and the three main religious communities of the nation: Muslim Sunni, Muslim Shiites and Christians. Accordingly, public and private schools were sampled purposively to achieve:

1) A wide range of schools from different socioeconomic catchment areas
2) Coverage of the three main religion sects from different regions in Beirut
3) An equal number of private and public schools.

Schools which were selected to be approached were also based on the following criteria:

- Number of students per class: Schools with at least 15 students in Grades Four or Five (age group 9-11 years) were sampled.
- Languages taught: The official Lebanese school curriculum requires two languages to be taught for all grades, in primary and secondary classes. Arabic is the first language taught, in addition students learn either French or English as a second language. Only schools with English as a second language were eligible to participate in this study, as some of the educational materials were bilingual, with Arabic and English language.

4.4 Schools selection

4.4.1 Sample size and randomisation

As per the National Survey of Household Living conditions *(Ministry of Social Affairs, 2008),* the age group of 10-14 years represents 10.3% of the Lebanese population, totalling 381,000 children. Children going to school then total to around 366,000, of which 172,000 (47%) attend public schools, and 194,000 (53%) attend private schools. The aim of this pilot study was to explore the effectiveness of the intervention and assess its feasibility in different types of schools and its impact in children from different socioeconomic and religious backgrounds. For this reason, a power calculation was not necessary and a sample comprised of eight private and public elementary schools was selected from the study population described previously.

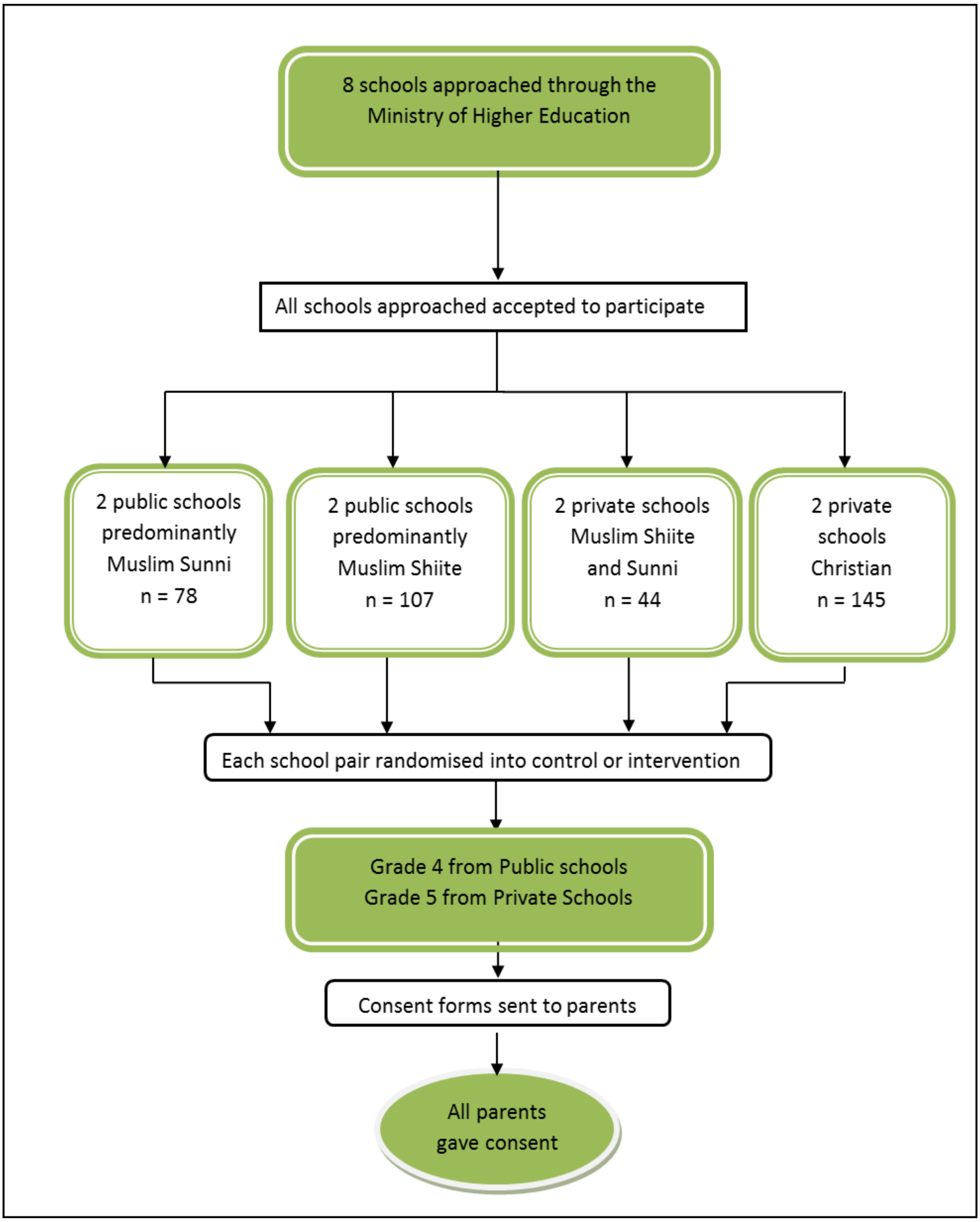
Accordingly, the school breakdown was as follows:

- Four private schools representing the higher socioeconomic status population with two schools comprised mainly of general Muslim families and two schools comprised mainly of Christian families.

- Four public schools representing the lower socioeconomic status population with two schools comprised of Muslim Shiite families and two schools comprised of Muslim Sunni families. The majority of Christian families of lower socioeconomic class do not usually send their children to public schools, but rather to private schools run by religious congregations such as catholic schools that charge low tuition fees. Due to time and budget constraints it was decided to divide school types at the level of public and private only, without going into sub-categories. Private schools run by Christian religious congregations that cater to lower SE families were excluded due to budget and time constraints. When the programme is disseminated in the future, this sub-category of schools should be included to ensure full coverage of all SE classes in Beirut.

Schools were paired according to neighbourhood, religious affiliation and school system into four comparable pairs. Randomisation into control or intervention took place within each pair with the toss of a coin. Intervention (n=4) and control (n=4) groups, consisted of four private and four public schools. Figure 4.1 presents a summary of the flow of stages for schools selection in the present study.

Figure 4.1: Flow stages for schools slectino in the present study



4.4.2 Study procedure

Children were recruited in several phases. Schools were approached through the Ministry of Higher Education. A letter explaining all components of the intervention was sent to schools, this was followed by a visit conducted by the researcher to the school principle to further provide details along with the aims and objectives of the study.

Figure 4.2 illustrates the flow progress of students in both groups from baseline and at the end of three months of intervention.

All eight schools approached, agreed to participate. Schools were asked to select one or two classes of children aged 9-11 years which corresponded to grades Four or Five to participate in the study. In public schools, students are usually older due to some age-grade delay. Therefore, in order to maintain the average age of the whole sample between 9-11 years, grades 4 were selected from public schools (same number from both intervention and control schools), and grades 5 from private schools (same number from both intervention and control schools). The total number of students invited to participate was 374, of which 193 students in intervention schools and 181 in control schools.

Consent forms were sent to students' parents/guardians to obtain their approval. The form also provided detailed information on the background, objectives and methods of the study. All parents approached approved that their children participate in the study.

The 100% participation rate could be explained by the following:

- Low burden on parents since the intervention was taking place within the school period and setting as compared with after-school programmes.
- Endorsement of the project by the Ministry of Higher Education and the school administration coupled with a rigorous follow-up by the school nurse.

- Higher awareness of the epidemic of childhood obesity that is spreading in the nation and the need to find solutions to the problem. The study was presented to parents as one possible answer to the prevention of childhood obesity.
- The reputation the American University of Beirut has established over the years gives this institution a high level of acceptance for usually many of its studies by the Lebanese population at large.

Figure 4.2 illustrates the flow progress of students in both groups at baseline and at the end of three months of intervention. Overall, 374 students were measured at baseline; 193 students in intervention schools and 181 in control schools. All of the eight schools enrolled in the programme completed the study. There was no drop out of the programme over the three months intervention period. One follow up visit was scheduled after the post-test to collect data from students who were absent at the time of measurement. In all, eleven students missed the data collection at the end of the intervention period due to absenteeism. In total 188 students were present at post-test in intervention schools and 175 in control.

Data collection for pre-assessment took place during the third week of January 2009, in private schools for both intervention and controls. For public schools the pre-assessment took place during the third week of January 2010 for both intervention and control schools. Post-assessments were carried out in May of 2009 for private schools and May 2010 for public schools, always during the same week for intervention and controls. The intervention sessions followed during the fourth week of January 2009 and 2010 for private and public schools respectively for three consecutive months. The period included the spring vacation (Easter vacation). Students in the control schools received their usual curriculum.

In its geographic location on the Mediterranean coast, Lebanon's weather system has four distinct and tempered seasons. Pre-assessment coincided in winter and post-assessment in spring. This could have impacted on some of the students' responses mainly concerning physical activity, although students' leisure time is quite constant during school days all along the academic year. Focus group interviews were conducted in intervention schools with a sub-sample of students, their parents and teachers. Table 4.1 presents the timeline followed for the implementation of the present research.

Table 4.1: Healthy PALS intervention timeline

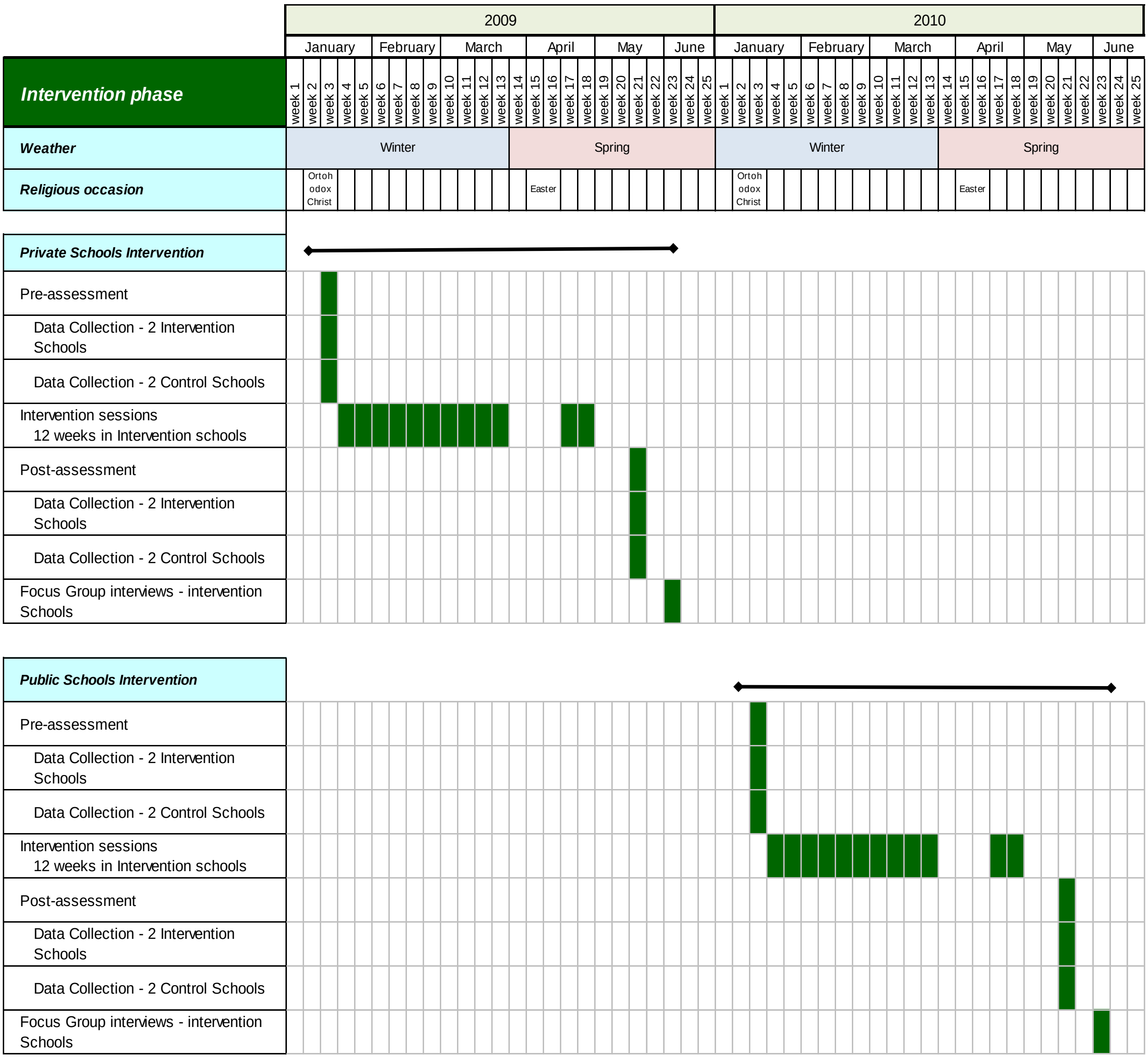
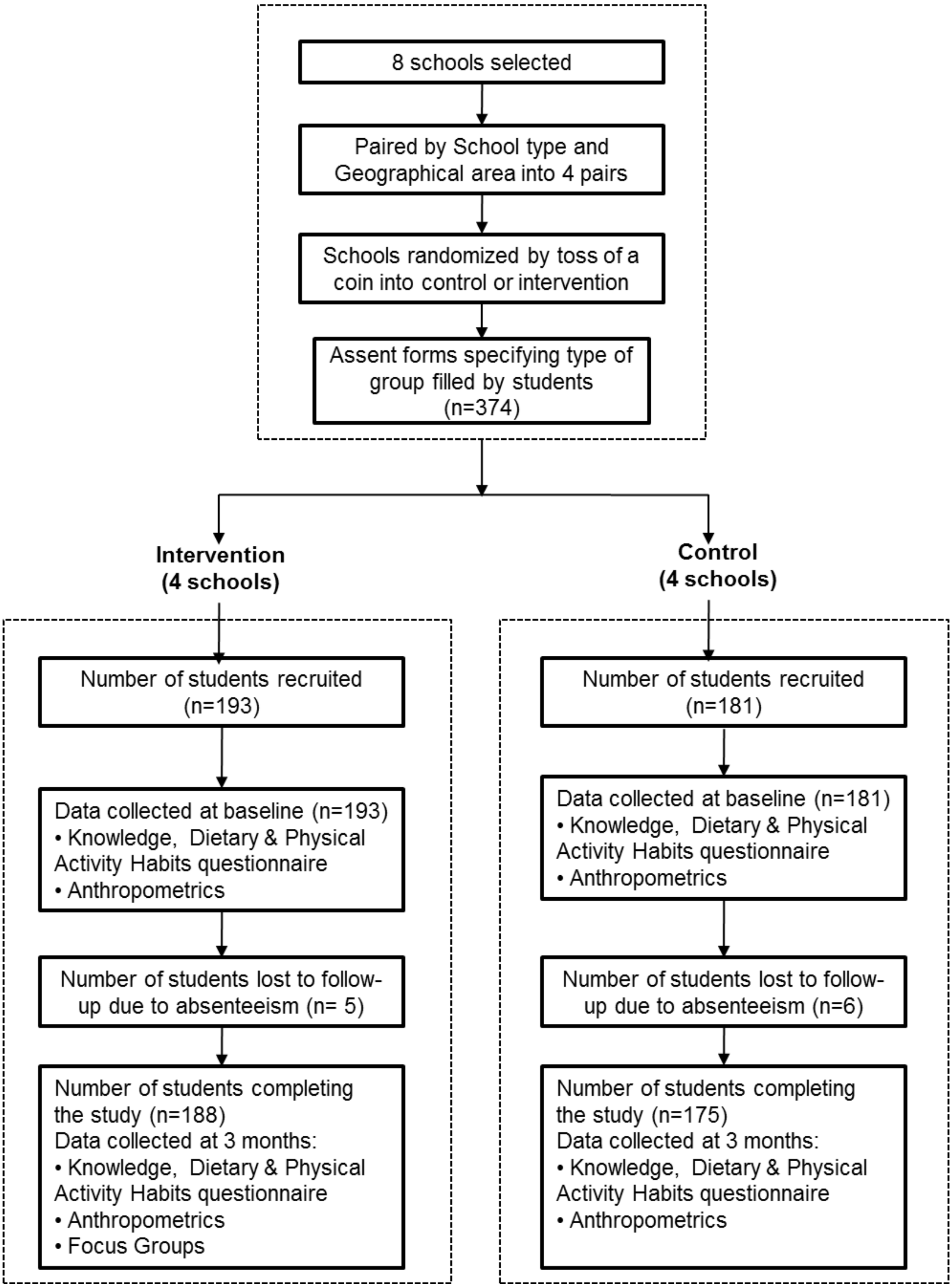


Figure 4.2: Students flow diagram



4.5 Intervention design

The school-based multicomponent intervention was named in Arabic ‘Kanz al Soha’; which translates to health treasure. ‘**Health-E-PALS**’ was deduced as the acronym for: Intervention to promote **Healthy** **E**ating and **P**hysical **A**ctivity in **L**ebanese **S**chool children.

The researcher developed the intervention components after consulting with a specialist in nutrition education who was part of the supervisory committee of the present thesis research. As this was an exploratory pilot trial, the supervisory committee recommended that the researcher delivers the intervention herself with the help of one assistant researcher, since studies have shown that efficacy trials should test if interventions will work under ideal conditions *(Baranowski et al, 2009)*. This is achieved when adequate resources are available to deliver the intervention exactly as designed with sufficient time to deliver it. The researcher further felt that conducting the pilot phase of this programme herself would provide her with a first-hand appreciation of the real field problems. This would facilitate the dissemination of this programme at a larger scale later. A plan for sustainability is proposed at the end of the thesis which addresses solutions to some problems faced in the field. Recommendations are also provided for feasibility of such projects using school staff in view of the future roll out plan of the intervention at the national level.

The following sections present details on the behaviours targeted in the intervention, the theoretical underpinning and the different components of the intervention.

4.5.1 Target behaviours

The intervention focused on the promotion of healthy eating and active living rather than the achievement of an ideal body weight. By selecting this focus the intervention aimed to lessen the chance of stigmatization of overweight children and of contributing to eating disorders *(Swinburn and Egger, 2002).*The ‘Health-E-PALS’ intervention targeted obesity related behaviours in 9-11 year old children that were the following :

1. Increase consumption of fruits and vegetables *(Chacar and Salameh, 2011, De Sa &Lock, 2008).*
2. Favour healthy snacks over high energy dense snacks and drinks *(Chacar and Salame; 2011, Malik et al, 2006b;Gibson & Neate, 2007; Drewnovski & Levine, 2003).*
3. Importance of having daily healthy breakfast *(Utter et al, 2007; Nasreddine et al, 2012a; Must et al, 2009; Patro&Szajewska, 2010; Duncan et al, 2008; bin Zaal et al, 2009; Tin et al, 2011; Utter et al, 2007).*
4. Increasing moderate physical activity *(Hwalla et al, 2005; Al Hazzaa, 2007).*
5. Decreasing sedentary behaviour*(Fazah et al, 2010, Hwalla et al, 2012).*

4.5.2 Theoretical underpinning

The theoretical underpinning of this programme is instruction with a behavioural focus; and goes beyond the acquisition of knowledge. Studies indicated that behavioural theory-based interventions were successful in bringing change since they emphasised motivators and skills that are needed to utilize these behaviours *(Hoelscher et al., 2002; Nixon et al, 2012).*The ‘Health-E-PALS’ intervention was based on the constructs of the Social Cognitive Theory *(Bandura, 1986)* which uses a multilevel approach involving individual behaviour change and environment modifications to support individual changes. Personal factors influencing individual behaviour include knowledge, skills and self-efficacy; Environmental factors include reinforcement, modelling and availability.

‘Health-E-PALS’ had three coordinated intervention components that addressed specific behaviour determinants: nutrition knowledge and awareness, skills, self-efficacy, covering personal factors. Modelling and availability covered the environmental factors.

The components were devised to work together to address behavioural and environmental factors related to students dietary and physical activity behaviours. Consistent with the Social Cognitive Theory, the components were based on the expectation that children will make healthier choices when introduced in a social setting that includes family and peers and uses active learning strategies. According to Bandura *(Bandura, 1986, 2004),* in order for an individual to perform a specific behaviour, he should know what to do and how it should be done; this is referred to as behavioural capability or knowledge; Skills training helps in increasing mastery learning. Strategies that increase self-efficacy include self-monitoring and reinforcement, such as rewards and praise.

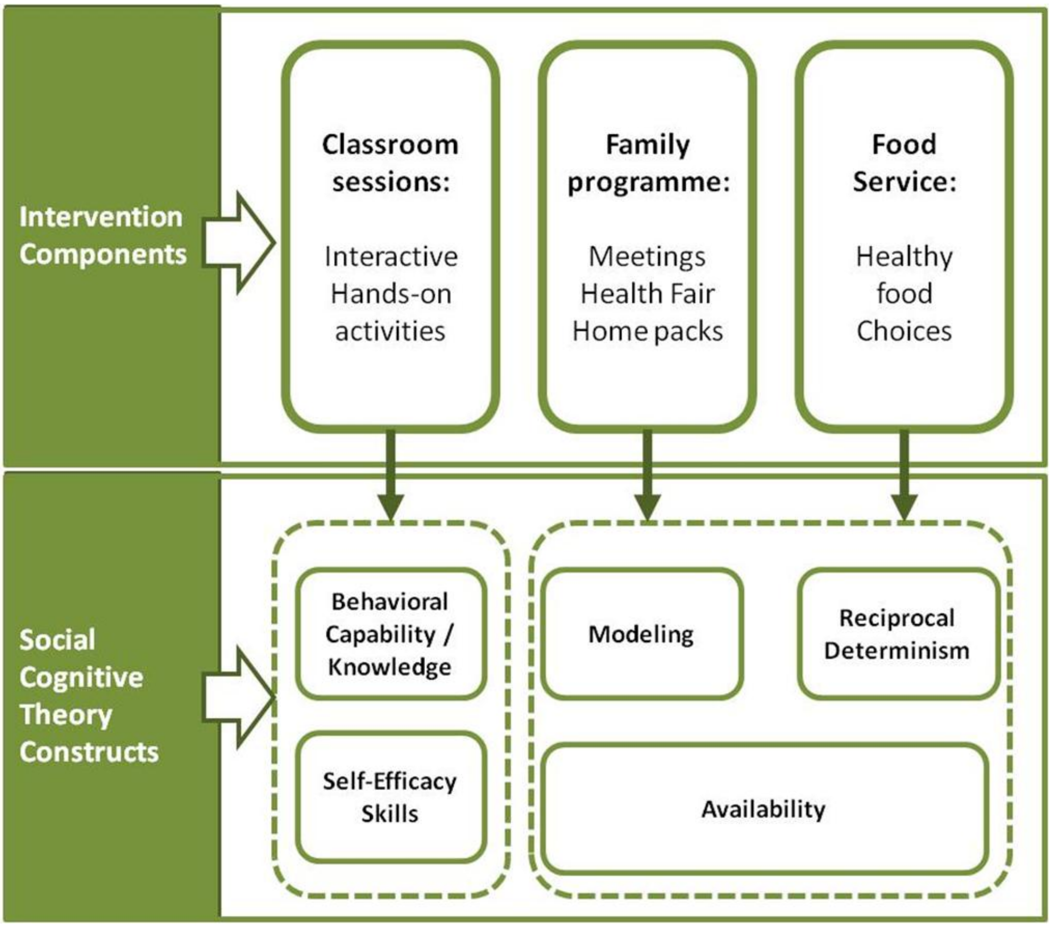
Role modelling refers to observational learning, where one learns by observing others actions, especially credible others, in this case the parents and teachers. Availability and accessibility of healthy food choices were also considered. Therefore, the intervention had the following components:

1- Culturally appropriate classroom sessions designed to promote healthy eating and physical activity. This component was designed to cover the personal and psychosocial determinants as outlined by the Social Cognitive Theory.
2- A family programme which introduces the intervention to families and assists them in creating a supportive environment at home for healthy lifestyle behaviours. This component covered the environmental factors at home: modelling and availability
3- A food service intervention targeting the school shop and the lunch boxes sent by the family. This component covered availability of food in the students' school environment.

Through these three components, 'Health-E-PALS' attempted to increase students' knowledge and efficacy about food choices and physical activity, and modify the school and family environment in order to provide more opportunities for exercise and healthy eating.

Figure 4.3 outlines the intervention components based on the Social Cognitive Theory constructs or determinants.

Figure 4.3 Intervention components, behavioural, personal and environmental constructs.



4.5.3 Intervention components

The following section describes each intervention component in more details.

4.5.3.1 Component 1: Classroom sessions

Educational material

Sessions' topics and activities were developed based on the five energy related behaviours targeted in the intervention.

The goal of the 'Health-E-PALS' intervention sessions was to provide appropriate nutrition education in a simple and fun layout. Delivery strategies reported to be effective in nutrition education include hands-on-activities, and interactive learning that gives opportunities to participate in discussions and food activities *(Birkett et al., 2004; Holston et al., 2004; Edward and Evers, 2001).*Consequently, activities such as games, hands on activities and food preparation were used to make the learning fun and interactive and the themes easy to remember and relate to. The 45 minute sessions were delivered each week for 12 weeks.

Some of the educational materials were customised from existing educational tools *(www.usda.gov; www.mangerbouger.fr; www.healthykidschallenge.com; Liakos C, 2006a,b)*; having worked both in the communication and dietary fields, the researcher was able to develop the rest. The nutritional information was based on the American Dietetic Association Nutrition Guidance for Healthy Children *(American Dietetic Association, 2008).* All materials were developed to suit Lebanese traditions and cultures, and featured traditional foods in most games, visual aids and recipes. Languages used on educational items were Arabic and English. However, only Arabic materials were used with students, except for some posters and food cards that were bilingual.

The educational component was designed to be integrative and interdisciplinary to facilitate implementation and minimize excess burden on existing school curriculum. During implementation, teachers were asked to be involved in the various activities in order to be prepared for the later sustainability plan. Nutrition sessions were integrated into various classroom subjects during the regular school day. For example, students used the measuring centres session to practice fractions in Math, and breakfast planning in writing topics in English or Arabic subjects. Each session consisted of two sections; 10 to 15 minutes of discussion, information and interaction about the topic of the week followed by 30 minutes of activity: game and/or food preparation. Teachers were participating in all phases of the sessions each during his class hour.

In order to make the sessions interesting and attractive to students, a set of visual aids have been developed. The teaching aids consisted of posters, pamphlets, activity booklets, card and board games (Box 4.1, Appendix E).

Box 4.1 'Health-E-PALS' educational Kit

- Classroom posters (10)
- Take Home pamphlets (12 for each student)
- Food diary booklet (one for each student)
- Physical activity booklet (one for each student)
- Set of 60 food cards
- Board game: Treasure game
- Traffic lights signs
- Food counter box (one for each student)
- Pedometers (one for each student)

Table 4.2 summarizes the topics, objectives, activities of the classroom sessions, with the determinants targeted and the class in which they were integrated.

Table 4.2: **Educational sessions' topics, objectives and tools with the matching theory determinant and class integration**

	Title of the lesson	Objectives of the lessons	Activity / Tool	Determinant	Class session
1	**Introduction to Food groups**	Classify one day food intake into food groups. Classify foods according to different food groups.	Game : Food cards	Knowledge	Science
2	**Food Groups and Nutrients**	Know the nutritional characteristics of each food group.	Food counter: Visual tool that helps students see what they ate	Knowledge	Science
3	**What is a portion**	Know the serving size of foods in different food groups.	Measuring centres: Real experience with food Food diary booklet	Knowledge	Math
4	**Fruits and vegetables: the rainbow colours**	Eat more fruits and vegetables Try new types of fruits and vegetables	Build a character with fruits and vegetables, tasting is a must	Self-efficacy and skills	Arts
5 & 6	**Physical activity**	Identify sedentary activities and try to minimize them. Increase regular Physical activities especially walking.	Pedometer workshop Activity booklet	Self-efficacy and skills	Sports
7	**Importance of breakfast**	The role and importance of breakfast Find ways to facilitate breakfast intake	Plan and prepare a healthy breakfast (breakfast is yummy)	Self-efficacy and skills	Language
8	**Healthy snacks**	Differentiate between healthy snacks and non-stop-nibbling. Prepare healthy snacks at home	Plan and prepare a healthy snack	Skills / Role modelling	Language
9	**Where do fats and sugars hide**	Identify high fat, high sugar containing foods	Game board: Treasure game	Knowledge	Math
10	**Clean teeth, good teeth**	Identify caries causing foods Brush teeth the correct way	Tooth brushing workshop	Self-efficacy and skills	Science
11	**Water is the best**	To explain why water is the best fluid. Encourage water intake instead of other sweet drinks	Water tasting workshop	Knowledge and skills	Social Studies
12	**Value of food**	Compare foods according to their nutrients and energy content.	Game: The traffic lights	Knowledge and skills	Civic Education

Material testing

Educational material were pilot tested on a group of seven to ten children aged 9-11 years who were related to the researcher and her colleagues. The children gathered few times during the summer vacation (July/August 2008), prior to the beginning of the academic year. They were exposed to the educational material (posters and pamphlets) and tried all the activities included in the educational sessions. These children were from middle and high socioeconomic classes.

Following the piloting several food illustrations were changed as well as some nutrition terms that were modified to wordings more accessible to children. The board and card games were re-adjusted to fit within a 30 minutes time frame. Snacks and recipes ingredients were altered to suit children's taste preferences:

- Different types of dried fruits and nuts for the trail mix snack recipe
- Amount of honey in milk shake recipe
- Quantity of sparkling water in the healthy orange fizz drink

Material content

The first two sessions of the 'Health-E-PALS' intervention aimed at introducing the different food groups and their nutrient content in relation to children's health. The Food cards that featured foods commonly consumed by children helped visualise and classify foods into the different food groups.

The third session included a hands-on-activity where children manipulated food to get familiar with portion sizes. Students also built a food counter; a visual aid helping students see what they ate. Food diary booklets where distributed at this stage, making children practice what they learnt.

Session four focused only on fruits and vegetables importance and consumption. Children were encouraged to taste new varieties of fruits and vegetables and prepared a food character from different fruits and vegetables.

Sessions five and six emphasized physical activity; the aim was to help children increase their activity level by participating in games and get more movement through daily walking. The Pedometer workshop introduced the 10,000 steps a day notion, children practiced activities such as running, ball games and others while wearing their pedometer. Pedometers were distributed to students and they were instructed on method of use. They were then asked to wear the pedometer and go to the playground where they had the choice of different games or activities: football, basketball, jogging… Children were encouraged to perform all of these activities and see how the steps were changing on the pedometer screen. They also noted what type of activities helped them reach the 10,000 steps faster. They were also encouraged to use it at home with their families. Activity booklets were distributed at this point to help students track their active hours and minimize the sedentary ones spent in front of a screen.

The aim of the pedometers use was to test whether it would be feasible to use pedometers in this age group. Compliance was found to be good, in a full trial, the use of the pedometers will be considered rather than accelerometers in case of budget constraints. It’s also worth noting that the pedometers purchased for the present study were low cost gadgets, not suitable for data collection.

Sessions seven and eight featured the importance of breakfast and healthy snacking by helping children plan a healthy breakfast and avoid skipping it. Children also learned to prepare a couple of healthy snacks.

The last four sessions emphasized nutrient dense foods compared to energy dense foods, through games showing the amounts of sugar and fat in foods. Students were also encouraged to choose water as their main hydrating fluid and learned to prepare a healthy fizzy drink to replace sugar loaded carbonated and sweetened beverages.

Give away gifts were used as positive reinforcements during some of the sessions and were provided for free by local companies. Examples of gifts offered to students included: footballs, jumping ropes, toothpaste and toothbrushes.

In order to illustrate how the sessions were structured each week, a detailed lesson plan for session four is described in Box 4.2. The rest of the lesson plans can be found in Appendix D.

Box 4.2 Lesson Plan: Fruits and vegetables the rainbow colours

Objectives:

At the end of the session, children will be encouraged to

- Eat more fruits and vegetables.
- Try new varieties of fruits and vegetables.

Points to discuss in class:

Fruits and vegetables: the rainbow colours

- Fruits and vegetables are rich in fibres, vitamins, minerals and phytonutrients.
- Phytonutrients are neither vitamins nor minerals but are found naturally in plants; they give fruits and vegetables their beautiful colours and work with vitamins and minerals to protect our body from many diseases.
- Fruits and vegetables are rich in water and low in calories.
- Include the 5 colour groups daily - red, yellow/orange, white, green, and blue/purple.
- We need to eat at least 5 fruits and vegetables a day to get all these benefits.

Activity: Mr Cocktail

Materials needed:

- Fruits and vegetables of different colours(rainbow colours)
  Example:
  Body: Orange or apple
  Head: tangerine or kiwi
  Arms and legs: cherry tomatoes or strawberries
  Green peas, mint leaves, raisins, cauliflower (eyes, nose, hair…)
- Toothpicks
- Plastic plates
- Plastic bags

Activity plan:

- Display fruits and vegetables by type and colour on counter or desk
- Distribute plates and toothpicks to children
- Be careful with safety when giving toothpicks to children
- Ask children to come up 2 by 2 to display desk to choose food items
- If time is short or very limited, the instructor or teacher can distribute food items to children
- Make sure to show the fruit character to children to use as a model, however, they can also use their imagination and be creative.
- When the activity is over, wrap each character in a take away plastic bag

4.5.3.2 Component 2: Family programme

The goal of the family involvement component is to introduce the programme to families and to assist them in creating a supportive environment at home for healthy lifestyle behaviours. The family intervention component consisted of the following activities:

- **Parents meetings:** Parents were asked to attend a school activity where the researcher introduced the different components of the project and provided information and guidance on the importance of healthy diet and physical activity. A healthy breakfast followed the meeting.
- **School events:** These consisted of health fairs involving interactive forums using the educational sessions' themes covered in class. The health fairs took place at schools at the end of the programme; parents were invited to participate in games prepared and presented by their children.
- **Take home pamphlets:** The intervention included sending the information home with the students as take home action packs after each session. These consisted of a summary of the major points covered during the educational session. Every time a recipe preparation followed during the activities, samples of food prepared were sent home with the students. The goal of the take home pamphlets was to try to address non-compliance/ poor attendance of parents' school meetings (Appendix E).

4.5.3.3 Component 3: Food service

Most Lebanese schools do not offer hot meals to their students. Cafeteria or cantinas are not available; except for some private schools. A typical school day in Lebanon starts at 8 am, and finishes at 2 pm for public schools and 3 pm for private schools. Students have two breaks of 15 to 30 minutes each during which they can have a quick snack prepared at home or bought from the school shop or kiosk.

Foods and drinks offered to students in school shops include convenience foods such as chips, candy bars, sweetened and carbonated drinks as well as ready prepared sandwiches, traditional Lebanese pastries, croissants and donuts. Fresh juices, fruits and vegetables are not available. Some private schools offer hot meals, of which very few are low fat and healthy. Lebanese schools do not have vending machines selling drinks. Snacks and beverages are only sold in shops and kiosks. The types of foods and snacks available to children are quite similar in all schools across Lebanon. Some items might differ between private and public schools, where private schools sell slightly more expensive varieties. The researcher had no control over changing food choices. She provided advice and recommendations concerning the healthy list of snacks and drinks that should be available to children in the shop with no authority to enforce any action. The decision to make alterations in the shops was solely up to the school administration. Some shops in private schools started offering cut fruits and vegetables as well as milk and rice pudding.

Most of the children in primary schools bring food from home to school, which also consists of sandwiches and convenience foods. This background led the researcher to focus the elements of the food service component on the school shop and the lunch box sent by the family.

School shop:

Several contacts and meetings where scheduled with the school shop administrators. The following recommendations and guidelines were discussed with the manager:

- Providing healthy food choices such as: low fat cakes and cookies, fruits and vegetables, low fat milk and 100% juice, nuts, dried fruits, sandwiches made from whole wheat bread.
- Offer less frequently energy dense snacks such as: chips, donuts, croissant, hot dogs, sweet and soft drinks.

Posters encouraging healthy food choices were posted at the points of sales whenever possible.

Lunch boxes:

Lunch boxes were examined and evaluated during the class intervention, with the help of the class teacher. The activity was conducted as follows: students were asked what they brought from home to school, examples included ham, cheese, labne (strained yogurt), chocolate spreads and jam sandwiches, chips, candy bars, water and sweetened drinks (artificial juice). Since this meal at school replaced a either breakfast or snack, the activity revolved around evaluating the content of the lunch box with regard to providing foods from the 3 different food groups, if it included a fruit or a vegetable and whether it provided more than one item with added fat or sugar. Students were encouraged to enhance the quality of their lunch box so as to provide at least one fruit or vegetable portion (such as cut carrots or apples, dried fruits etc...) and not to include more than one item with added sugars or fats.

4.6 Quantitative Data collection and analysis

In the following sections quantitative data collection and analysis are described as quantitative method was used first followed by the qualitative one.

4.6.1 Study variables

The study involved collecting continuous and categorical data on a number of variables some of which were primary and others secondary. The primary outcomes included children's dietary and physical activity behaviours, nutritional knowledge score, self-efficacy score and health beliefs. Secondary outcomes included children's body weight status: Body Mass Index (BMI) and waist circumference (WC).

4.6.2 Quantitative data collection

Data collection, using a pre-test and post-test design, took place one week prior to the start of the intervention and one week after the completion of the programme which was of three months duration, in both intervention and control schools. Tools used for the quantitative data collection included a questionnaire comprised of three main sections studying dietary and physical activity behaviours, nutrition knowledge and self-efficacy related to diet and physical activity. Anthropometric measurements were conducted to cover the secondary outcomes.

4.6.2.1 Student questionnaire used in the present study

Instruments assessing individuals' eating habits need to be easy and practical to administer to large populations and take into account time and cost *(Kristal et al, 1990).* In addition, the tool must be simple for children and adolescents to fill out, be reproducible and accurate. Questionnaires are often used as assessment tools in children and adolescents *(Caballero, 2003).* When the tool is to be self-administered, the minimum age of the child should be 10 years, as the cognitive abilities of children of that age and older is similar to that of adults *(Baranowski and Domel, 1994)*. By age 10 years, children are capable to give accurate information of their food consumption. As self-administration is less costly than interviewer- administration, and practical to use with children and adolescents, these were the reasons that led to the decision to use that type of tool in the present study. Questionnaires used to assess dietary behaviours need to be validated. Validation studies usually compare one tool with another that is judged superior *(Willet, 1998).* In the case of dietary questionnaires, assessment of validation is often conducted against diet records which are considered the gold standard in dietary assessments.

The questionnaire used in the present study included three main sections: Dietary and physical activity behaviours related questions, knowledge related questions and self-efficacy related questions (Appendix A). Details are provided below.

Dietary and physical activity behaviours section

The dietary and physical activity habits related questions were adapted from a previously developed questionnaire in the Faculty of Agriculture and Food Sciences at the American University of Beirut. The content validity of the original survey instrument was confirmed by a panel of experts consisting of one epidemiologist, one paediatrician and one nutritionist. The original version of the questionnaire was written in English and since the questionnaire was planned to be administered to children in the Arabic language, translation and back translation were used to ensure the reliability of the questionnaire. The original and back translated versions were reviewed for consistency in meaning by two bilingual experts.

Although this tool was not validated, the ability of a questionnaire to predict an established relationship between a dietary or physical activity habit and a physiologic response may be used as a qualitative evidence of validity in a manner equivalent to using a biochemical indicator *(Willet, 1998).* While few such relationships are established, this prediction of a Physiologic Response was recognized by studies that used the original questionnaire for some of the variables related to overweight and obesity in children *(Sibai et al, 2003, Hwalla et al, 2005; Nasreddine et al 2012c).*

The study by Sibai et al (2003) and by Hwalla et al (2005) was a cross-sectional survey conducted in 1997 on a representative sample of 2104 individuals aged three years and older. Anthropometric measurements and dietary assessments were carried to estimate the prevalence of overweight and obesity and examine associated covariates in the studied population. The study found an association between physical activity and Body Mass Index; children who do not exercise were over two times more likely to be obese than children who do.

A recent cross-sectional survey conducted in 2008 updated the 1997 one and used the same assessment tool *(Nasreddine et al, 2012c, Akl et al, 2011).*The study established a relationship between overweight and breakfast consumption; Odds of overweight were significantly lower among children consuming breakfast daily.

Because considerable evidence exists that skipping breakfast and decreased physical activity are associated with increased Body Mass Index in children, the demonstration of an inverse relationship between these two variables and body weight provides qualitative evidence that the questionnaire can measure some dietary and physical activity habits in children *(Willet, 1998).*

The questionnaire used in the present study was designed to give an indication of habitual eating and activity behaviour and not to measure energy intake or expenditure. Therefore, questions adapted from the original survey tool described above covered regular intake of meals, snacking, types of snacks eaten, and types of snacks bought from school shop, frequency of eating out, and eating in front of TV.

Physical activity questions covered sessions of physical education at school, playing outdoors at school and at home, after school times of structured activity per week. Sedentary behaviour was assessed using questions about screen time (time spent watching TV and time spent playing electronic games) during week days and weekends as most popular methods of recall separated weekdays from weekend days *(Bryant et al, 2007)* (Appendix A).

Five questions covering snacks bought from school shop, foods in lunch box, and foods chosen from supermarket were new additions to the survey: questions 7, 8, 9, 10 and 12.

Students' dietary knowledge section

Knowledge related questions were standard type and adapted from previously used questionnaires *(Webber et al, 1996)*. Translation and back translation from English to Arabic were used to ensure the reliability of the questionnaire. The content validity and the original and back translated versions were reviewed for consistency in meaning by a panel comprised of a bilingual expert and a nutrition education expert. The survey covered students' knowledge about healthy food choices, servings of fruits and vegetables recommended per day and fat and sugar content in selected foods. Correct answers scored one point. Incorrect and 'don't know' answers scored zero points (questions 24-37).

Students' self-efficacy and beliefs section

Self-efficacy related questions were standard type and adapted from previously used questionnaires *(Webber et al, 1996)*. Translation and back translation from English to Arabic were used to ensure the reliability of the questionnaire. The content validity and the original and back translated versions were reviewed for consistency in meaning by a panel comprised of a bilingual expert and a nutrition education expert. The survey tested students' beliefs and self-confidence in their ability to choose healthy foods and increase their physical activity. Items were scored on a Likert scale, with options of 'not sure', 'little sure' or 'very sure'. Higher scores indicated higher self-efficacy (questions 38- 49). While a 4 or 5-point Likert scale is superior to the 3-point in terms of capturing the more accurate feeling or attitude of participants, the decision to choose simplicity at the expense of sensitivity was taken to reduce participant burden. This was also done because previous work in this age group (≤ 12 years) suggested that participants engage more in a dichotomous thinking, "sure" and "not sure" response categories, and are more likely focused on the two extremes of the Likert type scaling *(Watson et al, 2006).*

4.6.2.2 Questionnaire testing

Prior to the intervention, the questionnaire was pilot tested with 25 children aged 9-11 years attending a class that was not included in the project (Appendix B). The pilot testing helped determine the time needed for questionnaire completion. It also facilitated detecting and validating comprehension and relevance of the questions. The following modifications were made after the testing:

- Snacks lists: Students noted that they usually have other foods than the ones listed for snacks. Consequently, more examples of food items were added to the questions listing foods eaten for snack and foods bought from school shop (5 and 8).
- Screen time: Students found it hard to correctly assess the timing they spent on screen time in minutes (television and electronic games). Therefore, the possible answers for questions 13 and 22 were rephrased into: a lot, or a little, and for a short time or for a long time respectively, instead of more or less than 30 minutes.

Answers for questions 14 and 23 were rephrased into: all day, once a day, twice a day.

In order for labels (short time, long time, once a day, twice a day) not to be open to interpretation, the researcher explained (during data collection) orally in more details the time frame involved (for example :twice a day as in 2 x one hour, a lot: more than 2 hours, long time: more than 2 hours)

- Knowledge section: A phrase indicating that only one answer should be chosen was added to questions 24, 25, 28, as students' circled more than one answer.
- Students were also confused when choosing the correct answer for questions asking about the content of fat and sugars in foods, as examples were listed in a same question: *which of these foods have less fats; fried potato or baked potato; croissant or corn flakes; chips or popcorn*. Therefore, each item was put in a separate question. The same applied for the question: *which of these foods have less sugar; milk or soft drinks, doughnuts or corn flakes, fresh juice or sweet drinks.*

The original questionnaire is found in Appendix B. The final modified questionnaire comprised a total of 49 questions and took 50 to 55 minutes to complete (Appendix A). English and Arabic versions of the questionnaire were prepared. Only the Arabic version was used, given that Arabic is the students' mother tongue.

To minimize bias from social desirability that might arise from self-report type questionnaires, students were told that there were no right or wrong answers as this was not a test and that data is confidential. Consequently they were asked to answer to questions as honestly as possible. Clear instructions on how to complete the questionnaire were defined on the front page.

The questionnaire was distributed to children in their classrooms; the researcher read aloud each question to the class and the corresponding available answers. Students read along with the researcher and then scored their answers on their copy of the questionnaire. An assistant researcher was walking around the classroom helping out children who had difficulties in understanding and completing the questionnaire.

4.6.2.3 Anthropometric measurements

Anthropometric measurements including height, weight, and waist circumference were carried out using standardized techniques and calibrated equipment *(Jelliffe and Jelliffe, 1989)*. The measurements were recorded pre and post intervention for all participants in intervention and control schools.

Subjects were weighed to the nearest 0.1 kg using a calibrated balance (Seca model 11770 Germany) in light clothing and with bare feet or socks/stockings. Height was measured with a stadiometer without shoes and recorded to the nearest 0.5 cm. Body Mass Index (BMI) was calculated using weight (in kilograms) divided by squared height (in meters). Waist circumference was measured with the use of a plastic measuring tape to the nearest 0.5 cm at the level of the umbilicus, at the midway between the inferior border of the ribs and the superior border of the iliac crest, with the subject standing erect and following normal breath expiration. Measurements were taken in the morning, two to three hours after breakfast and before lunch during both pre and post assessments.

4.6.3 Quantitative data analysis

The following sections describe in detail the statistical procedures performed by variable type. The Statistical Package for Social Sciences (SPSS) (*version 16*) and STATA (*version 12*) were used to run all quantitative analyses. Alpha was set at 0.05.

Statistical analysis

Exploratory data analysis was initially conducted and descriptive statistics were calculated using Pearson’s Chi-square tests and reported for all major study variables, including sample demographics. Observed and relative frequencies were reported for categorical variables, and measures of tendency and deviation were presented for continuous data. Regression models were then estimated, particularly Generalized Estimated Equations (GEE), in order to generate population-averaged estimates. Given that students were clustered within each school, robust standard errors were calculated to account for non-independence of student observations within each school (cluster=school).

Paired t-tests were used to assess the differences in means between pre and post surveys of each group alone. Independent t-tests assessed mean change differences between intervention and control groups.

Recoding Measures

Categorical measures were mostly recoded as binary due to small number of observations in certain categories, and to too many variable options. Recoding was conducted in a manner that retained theoretical integrity and meaningfulness of the responses. The variables were collapsed based on theory/practicality: the category with very small number of responses was collapsed with the one that made most theoretical sense. For example, for the breakfast question, we cared about students having daily breakfast intake, so the indicator for success was daily breakfast versus sometimes/never. In addition, The GEE models did not work well with multi-variables and thus we made the decision to collapse variables into just two categories. Recoded variables are presented in Table 4.3.

Table 4.3: Variables recoded

Variable name	Question	Variable recoding
Breakfast intake	Do you usually have breakfast: everyday, sometimes, I don't	Yes, No (sometimes and I don't coded as 'No")
Number of snacks per day	How many snacks do you have a day: once, twice, 3 or more	Once or twice, 3 or more
Eating out	How many times a week do you eat out: once or twice, 3 or more, never	Sometimes, 3 or more (never and once or twice coded as "sometimes")
Eating in front of TV	Do you eat in front of TV: yes, sometimes, No	Yes, No (sometimes and No coded as "No")
TV viewing during week days	Do you watch TV during weekdays: a little, a lot, No	Yes, No (a lot coded as "yes", a little and no coded as "No")
TV viewing during week ends	Do you watch TV during weekends: all day, once, twice, No	A lot, a little (all day and twice a day coded as "a lot", once a day and no, coded as "a little")
Electronic games during week days	Do you play computer games during weekdays: a little, a lot,3 times a week, No	Everyday, not everyday (a little and a lot coded as "everyday", 3 times a week and no, coded as "not everyday")
Electronic games during week ends	Do you play computer games during weekends: once a day, twice a day, all day, No	A lot, a little (all day and twice a day coded as "a lot", once a day and no coded as "a little")
Physical activity during recess	What do you play during recess: ball games, jumping rope, running games, You don't	Play, don't play (ball games, jumping rope and running games coded as "play")
Physical activity at home	What do you play at home: ball games, rollers, bicycle, you don't	Play, don't play (ball games, rollers and bicycle coded as "play")
After school physical activity	How many times a week you do sports after school: once, twice, 3 or more, No	No, At least once (once, twice and 3 or more coded as "at least once per week")
Health belief (1)	The food you eat can affect your health: yes, no, don't know	Yes, No (don't know and No coded as 'No")
Health belief (2)	The foods you eat now are healthy: yes, no, don't know	Yes, No (don't know and No coded as 'No")
Health belief (3)	People who weigh more may have health problems: yes, no, don't know	Yes ,No (don't know and No coded as 'No")

Computing Measures

Fourteen knowledge-based questions initially having the same response scale were summed into a single score (range: 0-14) after recoding into 1=correct and 0=incorrect response or don't know, to reflect overall student knowledge of nutrition. The internal consistency reliability of the knowledge items were examined at pre and post intervention. The Cronbach's Alpha measure of internal consistency was 0.66 at pre assessment and 0.7 at post assessment.

The nine items measuring self-efficacy-based questions were also summed into a single score (range 0-18). A 3-point Likert response format (0= not sure, 1= little sure, 2= very sure) was used for all nine questions. The Cronbach's Alpha measure of internal consistency was 0.66 at pre assessment and 0.7 at post.

Although a reliability of 0.70 or higher is required before using an instrument, the appropriate degree of reliability depends on various factors including constructs measured and the sample variability. As the between variability increases and within variance decreases, the reliability increases; meaning the more heterogeneous the sample, the more reliable the instrument in detecting those differences. The number of items per scale also influences reliability; the higher the number of "good" items the greater the internal consistency of the scale. Intercorrelations among test items are maximized when all items measure the same construct. When developing the knowledge questions, comprehension was the main concern and the questions were not developed to perform a scale. In fact, each question was intended to be studied on its own. However, realizing late that influencing "knowledge" levels as a whole is important, the answers were recoded into a dichotomous scale (correct/incorrect). As such, some information was lost leading to a lower internal consistency.

Box 4.3: Summary points from the quantitative assessment method

- The overall study used a sequential explanatory mixed methods design.
- The study was conducted in the capital Beirut, a cosmopolitan city comprising a melange of all religious and socio-economic sectors of the nation.
- The sample size was not based on power calculation and included eight schools purposively selected from different socio-economic and religious sectors of the country
- Data collection was completed using a self-report questionnaire covering students' dietary and physical activity habits, nutrition knowledge and self-efficacy.

4.7 Qualitative data collection and analysis

Qualitative data collection was carried out through semi-structured focus groups and in-depth interviews in intervention schools a few weeks after the completion of the intervention sessions. Focus group interviews were conducted with groups of parents and their children, and with groups of teachers. The aim of the interviews was to estimate the children's perception of the programme, what they liked and did not like and to verify what they have felt they have gained. The interviews also tried to obtain the parents' and the teachers' overall perception of the programme. An additional purpose of these interviews was to further explore and help explain the quantitative outcomes resulting from the intervention.

4.7.1 Participants' selection

All parents of students who took part in the programme were invited to participate in the focus groups interviews. Letters were sent through the school administration asking them to attend the informal meetings at school. Due to ethical reasons, only children of parents who responded to the invitation were selected to take part in the students' focus groups, as consents were obtained from the parents, for themselves and their children. The teachers who attended the educational sessions were invited to join the teachers' focus groups. Two in-depth interviews were conducted separately with the health coordinators of the public schools involved in the programme. Table 4.4 presents a summary of all qualitative data collection groups.

Table 4.4: Summary of Focus groups data collection: date of data collection, number of groups, participants and gender

Type of group	Total number of groups	Number of participants per group	Gender	Time of data collection	Total number of participants
Students	5 (2 from public schools and 3 from private schools)	Between 7 and 9	Mixed	June 2009 for private schools June 2010 for public schools	40
Parents	5 (2 from public schools and 3 from private schools)	Between 4 and 8	Predominantly females (only one father in one group)	June 2009 for private schools June 2010 for public schools	30
Teachers	3 groups from private schools and 2 in-depth interviews in public schools	Between 3 and 4	Females	June 2009 for private schools June 2010 for public schools	12

4.7.2 Qualitative data collection

Focus group interviews as tools for qualitative data collection have a number of advantages; they produce a significant quantity of data in a relatively short period of time, they let the researcher record and analyse members' reactions to questions and to each other, and they generate data and insights that would be less reachable without the interaction found in a group *(Schensul, 1999).* Focus groups tend also to decrease the chance of questions being misunderstood by respondents, and lessen socially desirable answers *(Morgan and Spanish, 1984; Morgan 1988).*

As with other qualitative methods, one of the limitations of focus groups discussions is the introduction of subjectivity in the collection and interpretation of data. However, this can be minimised when adequate care is taken in transcripts preparation *(Khan and Manderson, 1992)*.

In the current research, parents, students and teachers' group discussions were held separately. All were conducted at the school of the participants and lasted approximately 45 minutes. Group interviews were facilitated by a topic guide providing semi-structured open-ended interview questions (Box 4.5). Interviews were audio taped with the participants' permission. An assistant was present to take written notes and to check on the tape recordings. All interviews were carried out in colloquial Arabic. Questions were asked in a conversational manner which created an informal environment. Participants were encouraged to view their opinions frankly and freely and discuss them among each other. At the end of each session, the discussions were summarised and a short debrief was held with the assistant moderator.

As indicated earlier, two in-depth or 'one to one' interviews were conducted with the health coordinators at the public schools. As these persons are responsible for the health education in public schools, it was important to include their views and perceptions in the report. The interviews lasted approximately 45 minutes and were facilitated by the same interview guide used for the teachers' group discussions.

4.7.3 Qualitative data analysis

The recorded interviews were transcribed verbatim in Arabic to minimize errors arising from translation and thus to try to ensure fidelity in data capturing. Every one hour of recording time needed approximately four to five hours of transcription, which was consistent with estimates proposed by other studies *(Zemke and Kramlinger, 1985; Khan and Manderson, 1992)*. Each interview session was dated and the name of the school, the group and the interviewee were included. Data analysis was conducted using the thematic content analysis method outlined by Burnard *(Burnard, 1991).*This was completed through several steps summarised below:

<u>Step one:</u>

Notes were taken after each interview concerning the topics discussed, and the recorded interviews were transcribed verbatim in colloquial Arabic. Memos were made about any specific point that attracted the attention of the researcher during data collection, such as participant attitude, jargon words or others as these might help later in data interpretation.

<u>Step two:</u>

Each transcript was read several times to become familiar with the information and ensure data immersion *(Marshall and Rossman, 1995)*. Data familiarization is an important step for gaining an overview of the body of material assembled *(Ritchie and Spenser, 1994)*. Although the researcher was involved in all of the data collection, and had formed some hunches about key issues, this step helped in accumulating and gaining a feel of the material as a whole.

<u>Step three:</u>

The text was coded in English; Transcripts were coded by inserting a word or a phrase in the margins of the transcripts; next to segments of texts that related to important issues.

<u>Step four:</u>

Codes were grouped together under higher order headings according to recurrent themes, with overlapping ones under one theme. The researcher opted to avoid using the questions from the interview guide as the main themes, and instead allowed for the themes to emerge from the data itself.

Step five:

At this stage, an independent researcher, who was part of the Nutrition department at the American University of Beirut, was invited to read the transcripts and generate his own codes and themes. Both lists of codes were compared and contrasted and adjustments were made as needed. This step aimed at enhancing the validity of the categorising method and preventing researcher bias.

Step six:

Key findings were highlighted using colour coding, thus identifying emerging topics.

Step seven:

Each coded section was cut out and transferred to spread sheets or charts. Codes of similar colour were grouped together under the appropriate theme. A total of three charts were prepared: one for each group.

Step eight:

All of the sections were filed together to facilitate the writing up of the findings. During the writing up process, the researcher worked with each section selecting various examples of data that have been filed together and offered a commentary that linked the examples together. During all the process the researcher kept referring back to the original transcripts to stay close to the original meanings and contexts. Verbatim quotes were selected from the transcripts to illustrate the findings and ensure their conformability.

Box 4.4 Summary points from the qualitative assessment method

- The qualitative study involved a sub-sample of students in intervention schools with their parents and teachers.
- Data collection was completed through focus group interviews and semi-structured interviews.
- Participants groups comprised a total of 5 groups of children, 5 groups of parents, 3 groups of teachers and 2 interviews.
- Interviews were audio-taped and transcribed verbatim in colloquial Arabic.
- Data analysis was conducted using the thematic analysis method.

Box 4.5: Interview guides used in group and individual discussions

Parents' interview guide:

1. How interested are you with nutrition issues?
2. Who decides on the menu at home? Who does the grocery shopping?
3. What did you think of 'Health-E-PALS' project?
4. What did your kids tell you about the activities of 'Health-E-PALS'?(***Probes***: did they enjoy, why or why not, the activity you remember the most)
5. What kind of changes did you notice in your kids after the sessions? (***Probes*****:** *eating, exercise habits, buying different foods, time spent watching TV or playing video or computer games)*
6. Have you tried to change the way you or your family eats? If you have, can you describe what you tried to change? Why or why not?
7. Do you have any recommendations to improve the project 'Health-E-PALS'?

Students' interview guide:

1. Do you still remember the project 'Health-E-PALS'? *(Name some of the different sessions of the project, what was the purpose of* 'Health-E-PALS'*?)*
2. Can you tell me what you liked the most about the sessions*? (**Probes**: the session or activity you preferred the most, the sessions you liked the least and why)*
3. What did your parents think about the activities of 'Health-E-PALS'?
4. After the sessions, what changes have you done at home in your diet? (***Probes:*** *having breakfast, healthy snacks, eating more fruits and vegetables, drinking less soft drinks, eating less chips. If no changes, why?)*
5. Who can tell us about some meals or recipes they are preparing at home?
6. Would you like to participate again in 'Health-E-PALS' activities?
7. What changes/additions would you make to the activities in 'Health-E-PALS' project?

Teachers' interview guide

1. What did you think of 'Health-E-PALS' project?
2. What kind of changes did you notice in kids, after the sessions? *(**Probes:** Nutrition knowledge, eating habits, foods from home, bought from school shop).*
3. What kind of reactions did you notice after the pedometer workshop?
4. What were some of the kids' comments after each of 'Health-E-PALS' sessions?
5. How would you use 'Health-E-PALS' lessons in your class? *(**Probes**: willing to give it during classes, willingness to take some training...)*
6. Do you have any suggestions to improve 'Health-E-PALS' sessions?

4.8 Integration of quantitative and qualitative methods in the current study

In mixed methods studies it is of utmost importance to identify the stage at which the two approaches are to be integrated *(Tashakkori and Teddlie, 2007).*Researchers have defined several stages at which integration of both methods can occur *(Creswell et al, 2003).* This can be achieved at the data collection stage, the analysis stage or the interpretation stage. Given the aim of the present study and its design, sequential explanatory, it was best to integrate both methods at the interpretation stage. Outcomes for both methods are presented in the results chapter (5), interpretation of the results is combined for the quantitative and qualitative outcomes in the discussion chapter (6).

4.9 Process evaluation

A process evaluation documents and analyses the early development and actual implementation of the strategy or programme, and monitors and documents programme implementation. It can also aid in understanding the relationship between specific programme elements and programme outcomes *(Oakley et al, 2006)*. Process evaluation is also necessary to investigate background factors that affect an intervention.

The process evaluation of the present study verified whether the intervention was delivered with high fidelity and in adequate dose to the targeted population. It also documented which intervention components are effective and feasible. Challenges and barriers encountered during the programme implementation were identified as well. Data collection for the Health-E-PALS trial process evaluation was through direct researcher observation and parents and teachers comments. Data were collected on site during implementation, from family events and food service visits.

4.10 Ethical Approval

The current research has been granted an Ethical Approval by the Institutional Review Board of the American University of Beirut. The ethics committee reviewed and approved parents' consent forms, children's assent forms as well as all the tools used in data collection for quantitative and qualitative assessments (Appendix C). The written informed consents were sent to families and signed by the parent or legal guardian of the student prior to the initiation of the intervention. All students participating in the study also filled the assent forms. The letter of consent informed the parents of the nature and purpose of the research. Information about the methods of data collection was also provided. The subjects were assured of their right not to participate in the study or withdraw at any time.

In addition, at the beginning of each interview session, the students were briefed about the purpose of the study and the confidentiality and anonymity of the collected information.

Anonymity of the participants was insured by coding, each participant received a number code during the analysis, and the findings were reported for the group.

For qualitative assessments, parents gave written consent for themselves and their children to participate in group interviews (Appendix C). Verbal assents were then taken from children prior to the start of the interview sessions. All participating teachers signed a written informed consent for the teachers' interviews (Appendix C).

4.11 Research Funding

The current research was partly funded by the Eastern Mediterranean Regional Office Special Grant for Research in Priority Areas of Public Health (EMRPPH). It was established by the Regional Office for the Eastern Mediterranean of the World Health Organization (EMRO/WHO) in 2002. The focus of this EMRPPH call is Health Systems Research with emphasis on health policy and systems research. The funds were used to cover the following expenses:

- Educational material development and printing
- Costs of fresh foods used in classroom sessions and parents meetings
- Salary and transportation for one graduate assistant.

Chapter five: Data outcomes

This chapter describes the outcomes of the 'Health-E-PALS' programme at the end of three months of intervention. Data related to school and students' recruitment as well as general characteristics of the study sample is presented in this section. Quantitative data outlines baseline information followed by changes in dietary, physical activity and screen time behaviours as well as selected determinants of behaviour change such as knowledge, self-efficacy and health beliefs. A section on body composition of the students at baseline and post-intervention is also included. Qualitative data showing the main findings from the focus group interviews follows, illuminating the findings of the quantitative ones. Field challenges encountered during intervention implementation are included at the end of the chapter.

5.1 Schools recruitment

Both public and private schools were approached through the Ministry of Education. Ministry officials selected a convenience sample comprised of eight schools as described in chapter 3. Intervention (n=4) and control (n=4) groups, consisted of four private and four public schools. Table 5.1 presents general characteristics of the different school pairs.

5.2 Recruitment of children

All students in grades Four or Five were chosen from the eight schools. The total number of students within this age group was 387. Of the total number of students who were recruited to the project 193 received the intervention components and 181 received their usual school curriculum (Table 5.1). Boys represented 55 per cent of the sample and girls 45; the mean average age of the students in intervention schools was

10.3 (0.96) years and 10.1 (1.0) years in control schools. No significant differences were found between intervention and control students for any of the measures.

Table 5.1 shows the baseline characteristics of the students in their respective school pairs. Data on number of students per class and per school, school type, age, gender and anthropometric measures are presented for intervention and control groups.

Table 5.2 presents the BMI by gender and school type, with proportions of students considered overweight and obese by gender.

Table 5.1: General characteristics of students and schools included in the programme

	School pair 1		School pair 2		School pair 3		School pair 4		Total Schools	
	Intervention	**Control**	**Intervention**	**Control**	**Intervention**	**Control**	**Intervention**	**Control**	**Intervention**	**Control**
No. of students	21	23	79	66	51	56	41	37	193	181
School Type	Private	Private	Private	Private	Public	Public	Public	Public	4	4
Annual Fees (US$)	2000	3000	4000	3000	100	100	100	100		
Main Religious affiliation	Mixed Muslim sects	Mixed Muslim sects	Christian	Christian	Muslim Shiite	Muslim Shiite	Muslim Sunni	Muslim Sunni		
School shop	Available	Available	Available	Available	Available	Available	Available	Available	Available	Available
Average Students /class	21	23	26	22	25	28	20	19	23	23
No. Of teachers/ class	7	7	7	7	7	7	7	7	7	7
Gender										
Male %(n)	38 (8)	52 (12)	55(43)	52 (39)	59 (30)	55 (31)	71 (29)	46 (17)	57(111)	53(93)
Female %(n)	62(13)	48 (11)	45 (36)	48 (27)	41 (21)	45 (25)	29 (12)	54 (20)	43(82)	47(88)
Mean Age (yrs) ± SD	9.6±0.6	9.3 ± 0.5	10.4±0.5	10.2±3.5	10.6±1.2	10.4±1.2	10.4±1.2	9.9±1.1	10.3±0.96	10.1±1
Mean BMI ± SD	20.2±3.6	19.8 ± 3.2	20.8±4	19.9±3.5	18.9±3.8	17.3±3.2	18.4±3.8	18.5±3.3	19.7±4	18.8±3.5
Mean Waist circumference (cm) ± SD	69.9±9.2	66.8 ± 7.8	75.1±11.5	72.6±9.7	68.8±8.7	65±9.1	65.7±8.5	68±8.7	70.9±1.1	69.8±1

Table 5.2: Prevalence of overweight and obesity in intervention and control schools according to WHO Z scores*

	Overweight (including obese)		Obese	
	Male	Female	Male	Female
	% (n)		% (n)	
Intervention	53.2 (59)	40.2 (33)	26.1 (29)	20.7 (17)
Control	44.1 (41)	37.5 (33)	17.2 (16)	10.2 (9)
Total	49.0 (100)	38.8 (66)	22.1 (45)	15.3 (26)

**Overweight Z >1, Obese Z > 2 (De Onis et al, 2007a)*

5.3 Quantitative data presentation

Data outcome concerning students dietary habits, physical activities, screen time habits, knowledge, self-efficacy and health beliefs are presented in this section. General descriptive information on frequencies of students' responses at baseline is presented, followed by the changes for each of students' habits and determinants of behavioural change, as well as body composition.

5.3.1 Students dietary habits at baseline and post-intervention

Students' dietary habits are reported for breakfast and snack intake, types of snacks consumed, types of foods purchased from the school shop, and eating out. Eating out includes meals taken at restaurants or delivered at home.

<u>Breakfast, Snacks, Eating-out</u>

- Descriptive information on frequencies of responses for students' dietary habits for breakfast, snacks, number of snacks consumed per day and eating out are shown in Table 5.3, at baseline and at post in both intervention and control groups. Descriptive information by school type and gender is found in appendix G, tables 5.3.1 and 5.3.2 respectively.

  A small percentage of students both in the intervention and control groups reported not having breakfast; however a third of them were not having it on regular basis. On the other hand, most of the students in both groups reported having snacks between their meals (97.9%, 96.7% respectively).There was no difference in all dietary habits between groups at baseline, except for buying foods from school shop and bringing food from home to school; students in control schools were buying more foods from the school shop and bringing less food from home. This was probably because the matching was done at the school level; schools were matched based on socioeconomic status, religious affiliation and geographical areas; there may always remain some variability at the individual student behavioural or trait personalities.

Table 5.3: Frequencies of students' behaviours Pre and Post intervention / Dietary habits

Dietary Habits	Baseline Intervention (n=193)	Baseline Control (n= 181)	Baseline *P** value	Post-Intervention Intervention (n=193)	Post-Intervention Control (n=181)	Post-Intervention *P** value
	%(n)			%(n)		
Do you usually have Breakfast			0.085			0.001
Everyday	71.4 (137)	63.0 (114)		76.5 (143)	48.0 (84)	
Sometimes	26.6 (51)	33.1 (60)		21.4 (40)	45.1 (79)	
Never	2.1 (4)	3.9 (7)		2.1 (4)	6.9 (12)	
Do you usually have Snacks			0.46			0.42
Yes	97.9 (189)	96.7 (175)		94 (177)	92 (161)	
No	2.1 (4)	3.3 (6)		5.9 (11)	8 (14)	
How many snacks per day			0.82			0.04
One or Two	55.9 (107)	57.1 (100)		77.9 (146)	68.1 (119)	
Three or more	44.1 (85)	42.9 (76)		22.1 (41)	31.9 (56)	
Do you buy food from your school shop			0.001			<0.001
Yes	79.8 (154)	92.3 (167)		71.8 (135)	94.3 (166)	
No	20.2 (39)	7.7 (14)		28.2 (53)	5.7 (10)	
Do you get food from home to school			<0.001			<0.001
Yes	89.1 (172)	73.5 (133)		86.6 (161)	69.5 (121)	
No	10.9 (21)	26.5 (48)		13.4 (25)	30.5 (53)	
Do you eat while watching TV			0.09			0.027
All the time	18.1 (35)	14.4 (26)		9.6 (18)	16 (28)	
Sometimes	60.1 (160)	70.7 (128)		66.5 (125)	69.7 (122)	
No	21.8 (42)	14.4 (27)		23.9 (45)	13.7 (24)	
How many times do you eat out per week			0.2			0.3
Three or more	15.8 (30)	17.7 (32)		13.9 (26)	19.5 (34)	
Once or twice	62.6 (119)	54.7 (99)		62.6 (117)	60.9 (106)	
Never	21.6 (41)	27.6 (15)		23.5 (44)	28.3 (34)	

** p value significant at p < 0.05. Values derived from Chi-square tests for all the variables*

Although the majority of students in the intervention and control schools took food from home to school (89.1%, 73.5% respectively), they still bought snacks from the school shop (79.8%, 92.3% respectively). Eating out refers to meals taken outside home or delivered from fast food restaurants. The majority of children, in both groups, reported eating out once or twice a week at baseline (Table 5.3).

- Changes in breakfast, snack, eating out and eating in front of TV habits at the end of the study*:*

  Table 5.4 illustrates the dietary habits of intervention students at post-test controlling for baseline measures. Results show that the odds of reporting having breakfast daily for an intervention student was 3.5 times ($p<0.001$) that of a control student at post-test (OR= 3.5; CI=1.8; 6.9). We can also observe that the odds of reporting eating in front of TV for an intervention student was 56% less than a control student at post-test, controlling for baseline measures (OR= 0.44; CI= 0.23; 0.85; $p=0.01$). There were no changes in the number of snacks taken per day and the number of times students ate out per week.

Table 5.4:Odds ratio comparing breakfast intake , snacks, eating in front of TV and eating out in intervention versus control groups at post-intervention, controlling for baseline measures*

Dietary habit	Odds Ratio	95% CI	*P* value**
Breakfast intake	3.5	1.8; 6.9	<0.001
Number of snacks per day(3 or more)	0.62	0.34; 1.15	0.13
Eating in front of TV	0.44	0.23; 0.85	0.01
Eating out (3 or more per week)	0.7	0.35; 1.38	0.3

** Baseline measure refers to the response provided at pre intervention.** Significant at p<0.05*

- Types of snacks consumed

The different types of snacks consumed by students between meals are shown in Table 5.5 at baseline and post-intervention for both groups. There were no differences between the intervention and control groups in types of snacks consumed at baseline, except for soft, sweetened drinks and fruits. Students in the intervention group reported eating more fruits and drinking less soft, sweetened drinks at baseline. Descriptive tables showing the results by school type and gender are found in appendix G (tables 5.5.1 and 5.5.2 respectively).

Table 5.5: Types of snacks consumed between meals, all day in intervention and control groups

What do you have for snacks	**Baseline**			**Post Intervention**		
	Intervention (n=193)	**Control (n=181)**	***P* value**	**Intervention (n=193)**	**Control (n=181)**	***P* value**
	% (n)			**% (n)**		
Chips	39.9 (77)	41.4 (75)	0.76	11.7 (22)	40.0 (70)	**<0.001**
Soft drinks	25.9 (50)	39.8 (72)	**0.04**	8.5 (16)	26.3 (46)	**<0.001**
Chocolate or Biscuits	49.0 (94)	51.9 (94)	0.57	27.7 (52)	36.4 (64)	0.07
Sweet drinks	64.2 (124)	48.6 (88)	**0.002**	43.6 (82)	52.8 (93)	0.94
Fruits	74.6 (144)	62.4 (113)	**0.01**	70.2 (132)	55.7 (98)	**0.004**
Sandwich	39.9 (77)	40.3 (73)	0.93	39.9 (75)	41.5 (73)	0.15

** p value significant at p < 0.05. Values derived from Chi-square tests for all the variables*

- Changes in types of snacks consumed at the end of the study*:*

Table 5.6 shows the odds ratios of snacks that students reported taking post-test in intervention students, compared with controls, controlling for their answer at baseline. The odds of reporting having chips as snacks for students in the intervention group was 86% less (p<0.001) than that of students in the control group at post-test (OR= 0.14; CI= 0.11; 0.19). It is also noted that the odds for reporting drinking soft drinks for students in the intervention group was 88% less (p<0.001) than that of students in control group at post- test, controlling for baseline measures (OR= 0.12; CI= 0.04; 0.29). The odds of reporting having fruits as a snack for students in the intervention group was 1.65 times that of students in control group with no statistical significance between groups (OR= 1.65; CI= 0.87; 3.1). There was no statistical significance in change for the other types of snacks (chocolate, sweetened drinks and sandwich).

Table 5.6: Odds ratio comparing intake of snacks between meals in intervention versus control groups at post-intervention, controlling for baseline measures*

Type of Snack	Odds Ratio	95% CI	*P* value**
Chips	0.14	0.11; 0.19	<0.001
Chocolate	0.54	0.25; 1.15	0.11
Soft drinks†	0.12	0.04; 0.29	<0.001
Sweetened drinks‡	0.47	0.16; 1.4	0.178
Fruit	1.65	0.87; 3.1	0.12
Sandwich	1.5	0.78; 2.9	0.22

**Baseline measure refers to the response provided at pre-intervention. **Significant at p <0.05. † include carbonated beverages. ‡include artificial juices and drinks*

- Snacks purchased from school shop

The types of foods students reported buying from the school shop are presented in Table 5.7 at baseline and post-intervention for both groups. There was no significant difference between the types of foods purchased from the school shop among groups at baseline except for croissant. Tables 5.7.1 and 5.7.2 (appendix G) show the findings by school type and gender respectively.

Table 5.7: Frequency of food purchased from school shop in intervention and control groups

What do you buy from the school shop	Baseline			Post Intervention		
	Intervention (n=193)	Control (n=181)	*P* value	Intervention (n=193)	Control (n=181)	*P* value
	% (n)			% (n)		
Chips	24.6 (47)	29.8 (54)	0.26	8.0 (15)	29.5 (52)	**<0.001**
Soft drinks	18.3 (35)	24.3 (44)	0.16	3.7 (7)	19.9 (35)	**<0.001**
Chocolate or Biscuits	39.8 (76)	48.1 (87)	0.11	19.1 (36)	42.0 (74)	**<0.001**
Sweet drinks	50.8 (97)	49.2 (89)	0.76	35.6 (67)	52.8 (93)	**0.001**
Croissant	34.6 (66)	21.0 (38)	**0.004**	18.6 (35)	21.6 (38)	0.48
Manouche	44.0 (84)	52.5 (95)	0.1	36.2 (68)	41.5 (73)	0.3

** p value significant at p < 0.05. Values derived from Chi-square tests for all the variables*

- Changes in food purchased from school shop at the end of the study*:*

  Table 5.8 shows the changes in students' purchases from school shop controlling for their answers at baseline. We can observe that the odds of reporting buying chips for an average intervention student was 84% less (p=0.008) than that of an average control student at post-test (OR= 0.159; CI= 0.04; 0.61). We can also note that the odds of reporting buying soft drinks and chocolate were respectively 89% (OR= 0.115; CI= 0.04; 0.29) and 71% (OR= 0.286; CI= 0.12; 0.66) less for an intervention student than a control student at post-test. The other food items did not show any significant change.

<u>Table 5.8:</u> Odds ratio comparing purchase of snacks from school shop in intervention versus control groups at post-intervention, controlling for baseline measures*

Snack bought	**Odds Ratio**	**95% CI**	***P* value****
Chips	0.159	0.04, 0.61	0.008
Chocolate	0.286	0.12; 0.66	0.003
Soft drinks†	0.115	0.04; 0.29	<0.001
Sweetened drinks‡	0.396	0.15; 1.07	0.068
Manoushe^	0.797	0.4; 1.5	0.52
Croissant	0.636	0.34; 1.12	0.157

** Baseline measure refers to the response provided at pre-intervention. **Significant at p <0.05. † include carbonated beverages. ‡include artificial juices and drinks. ^Lebanese pastry*

5.3.2 Students physical activity habits at baseline and post-intervention

Students' physical activity habits are reported below for frequency of playing outdoors at school and at home as well as number of times of physical activity per week after school and during weekends. Two physical exercise (PE) classes a week constitute the usual mandatory curriculum, both in public and private schools, in Lebanon. The majority of students (91%) in both groups reported regular participation in the school PE classes.

- <u>Physical activity habits</u>

  Table 5.9 describes students' physical activity habits at baseline and at post, in intervention and control groups. Tables 5.9.1 and 5.9.2 (appendix G) show the findings by school type and gender respectively.

  There was no significant difference in time spent playing outdoors in schools and at home between groups at baseline. Similarly, hours of physical activity after school and during weekends were comparable in the intervention and control groups at baseline.

Table 5.9: Frequencies of students' behaviours pre and post intervention/ physical activity habits

	Baseline			Post Intervention		
Exercise Habits	**Intervention (n=193)**	**Control (n= 181)**	***P* value**	**Intervention (n=193)**	**Control (n=181)**	***P* value**
	% (n)			**% (n)**		
Do you play at recess			0.49			0.14
Yes	83.4 (161)	80.7 (146)		88.3 (166)	82.9 (145)	
No	16.6 (32)	19.3 (35)		11 (22)	17.1 (30)	
Do you play at home after school			0.9			0.1
Yes	31.6 (61)	30.4 (55)		47.8 (89)	41.7 (73)	
Sometimes	30.6 (59)	32.0 (58)		21.0 (39)	30.9 (54)	
No	37.8 (73)	37.6 (68)		32.4 (60)	28.3 (49)	
How many times you do sports after school or during weekend			0.59			0.14
Three or more	39.2 (75)	40.9 (74)		61 (116)	55.8 (97)	
Once or twice	46.3 (89)	48.1 (87)		32 (60)	32.8 (57)	
I don’t	14.6 (28)	11.0 (20)		5.9 (11)	11.5 (20)	

** p value significant at $p < 0.05$. Values derived from Chi-square tests for all the variables*

- Changes in physical activity habit at the end of the study:

Table 5.10 presents the changes in physical activity for intervention group at post-test, compared with control group, controlling for baseline measures. The odds of intervention students reporting playing at recess is 1.4 times that of control students (p=0.03) at post-test (OR= 1.38; CI= 1.0; 1,8). However the odds for students reporting playing at home at post did not change. We can also observe that for after school sports activities such as ball games, martial arts, dancing and swimming classes the odds of an intervention student to engage in at least once a week after school activity is 2.3 times that of a control student at post (OR= 2.35; CI= 0.97; 5.65). However the results did not reach statistical significance.

Table 5.10: Odds ratio comparing physical activity habits in intervention versus control groups at post-intervention, controlling for baseline measures*

Physical Activity Habit	Odds Ratio	95% CI	*P* value**
Playing at recess	1.38	1.0; 1.8	0.03
Playing at home after school	0 .86	0.49; 1.52	0.62
After school Physical activity per week (at least once/week)	2.35	0.97; 5.65	0.057

** Baseline measure refers to the response provided at pre-intervention.*
*** Significant at p <0.05*

5.3.3 Students screen time habits at baseline and post-intervention

Students' screen time habits are reported for the frequency of time spent watching television and playing electronic games during school days and weekends

- Screen time habits: Table 5.11 describes students' screen time habits at baseline for both groups. A majority of students (>80%) in both groups watch television on a daily basis even during school days. Electronic games are also a common habit amongst students with more than 60% play time daily. Tables 5.11.1 and 5.11.2 (appendix G) show the findings by school type and gender respectively.

Table 5.11: Frequencies of students' behaviours Pre and Post intervention / screen time

Screen time	Baseline			Post Intervention		
	Intervention (n=193)	Control (n= 181)	*P* value	Intervention (n=193)	Control (n=181)	*P* value
	% (n)			% (n)		
Do you watch TV during week days			0.09			0.85
a lot	31.2 (60)	29.3 (51)		30.1 (53)	32.2 (55)	
a little	50.5 (97)	59.8 (104)		54.0 (95)	53.8 (92)	
I don't	18.2 (35)	10.9 (19)		15.9 (28)	14 (24)	
Do you watch TV during weekends			**0.03**			0.09
all day	29 (56)	28.9 (52)		27.1 (51)	28.7 (50)	
twice a day	26.9 (52)	39.4 (71)		26.1 (49)	31.0 (54)	
once a day	37.8 (73)	28.9 (52)		38.8 (73)	37.9 (66)	
I don't	6.2 (12)	2.8 (5)		8.0 (15)	2.3 (4)	
Do you play electronic games after school			0.82			0.78
every day for a long time	18.1 (35)	19.3 (35)		16.2 (30)	16.1 (27)	
every day for a short time	40.9 (79)	40.3 (73)		44.9 (83)	39.9 (67)	
3 or more times a week	24.4 (37)	21 (38)		19.5 (36)	22.0 (37)	
I don't	16.6 (32)	19.3 (35)		19.5 (36)	22.0 (37)	
Do you play electronic games during weekend			0.5			0.9
all day	19.8 (38)	25.6 (46)		20.9 (39)	23.6 (41)	
twice a day	28.6 (55)	24.4 (44)		28.3 (53)	25.9 (45)	
once a day	39.6 (76)	37.8 (68)		36.9 (69)	36.2 (63)	
I don't	12.0 (23)	11.7 (21)		13.9 (26)	14.4 (25)	

** p value significant at $p < 0.05$. Values derived from Chi-square tests for all the variables*

- Changes in screen time habits: There was no significant effect on screen time habits following the intervention. Students' reporting on their television viewing and time spent playing electronic games did not change at post-test (Table 5.12).

Table 5.12: Odds ratio comparing screen time habits in intervention versus control groups at post-intervention, controlling for baseline measures*

Screen time	Odds Ratio	95% CI	*P* value**
TV viewing school days	0.86	0.50; 1.47	0.58
TV viewing week end	0.88	0.43; 1.8	0.73
Electronic games schooldays	1.32	0.75; 2.34	0.34
Electronic games weekend	1.05	0.35; 1.38	0.89

** Baseline measure refers to the response provided at pre-intervention.*
*** Significant at p <0.05*

5.3.4 Determinants of behavioural change at baseline and post-intervention

The selected determinants of behavioural change which were studied were knowledge, self-efficacy and health beliefs.

- Knowledge and Self-efficacy: Students' dietary knowledge and self-confidence in their ability to choose healthy foods (self-efficacy) and increase their physical activity are presented in table 5.13, at baseline and post-intervention. The maximum score for the dietary knowledge questions is 14, with a higher score reflecting better knowledge of healthy foods, fat and sugar content of foods, and exercise recommendation. The maximum score for the self-efficacy questions is

18, with a higher score indicating a better self-confidence in healthy lifestyle choices.

The mean scores for dietary knowledge and self-efficacy at baseline were the same in intervention and control groups ($p>0.05$). As shown in table 5.12, the scores for both knowledge and self-efficacy increased for the intervention group from pre-test to post-test, while remaining relatively similar for the control group. Upon comparing the mean difference in intervention and control groups for both dietary knowledge and self-efficacy, a statistically significant change is observed, this further highlights that the magnitude of the change in knowledge and self-efficacy scores was significantly greater in the children in the intervention group compared to those in the control group ($p< 0.001$, Table 5.13).Tables 5.13.1 and 5.13.2 (Appendix G) show the findings by school type and gender respectively.

Table 5.14 presents the knowledge questions data broken down by question, for both groups at baseline and post-intervention. The main areas of improvement in knowledge post-intervention pertained to the servings of fruits and vegetables that should be consumed per day, the amount of fats in foods and water as the best fluid for the body.

<u>Table 5.13</u>: Knowledge and self-efficacy scores at baseline and post intervention in intervention and control groups.

	Mean ± SD at Baseline		Mean ± SD Post Intervention		Mean Change ±SD		
Determinant	**Intervention group (n=193)**	**Control group (n=181)**	**Intervention group (n=193)**	**Control group (n=181)**	**Intervention group**	**Control group**	***p* value***
Knowledge† score	8.7 ± 3.0	8.9 ± 2.7	11.5 ± 3.0	8.5 ± 2.8	2.8 ± 3.4	-0.4 ± 3.4	**<0.001**
Self-Efficacy‡ score	14.3 ± 2.7	13.8 ± 2.8	16.0 ± 2.6	13.7 ± 3.3	1.7 ± 3.1	-0.1 ±0.2	**<0.001**

** p value significant at p<0.05. Values derived from independent t-test for all variables*
† the sum of correct answers(correct=1, incorrect, don't know=0)
‡ the sum of answers (not sure=0, little sure=1, very sure=2)

Table 5.14: Knowledge questions breakdown for intervention Vs. controls at baseline and post-intervention

Knowledge question	Baseline Intervention (n=193)	Baseline Control (n= 181)	Post Intervention Intervention (n=193)	Post Intervention Control (n=181)	*P* * value
	% (n)		% (n)		
From which type of food I should eat the least					
Correct	67.4 (130)	70.2 (127)	66.8 (125)	60.9 (106)	**0.241**
Incorrect	32.6 (63)	29.8 (54)	33.2 (62)	39.1 (68)	
From which type of food I should eat the most					**0.026**
Correct	25.4 (49)	36.9 (66)	56.1 (105)	42.3 (74)	
Incorrect	74.6 (144)	63.1 (113)	43.9 (82)	57.7 (101)	
How many servings of fruits & vegetables I should have a day?					**<0.001**
Correct	14.5 (28)	17.1 (31)	67.4 (126)	31 (54)	
Incorrect	85.5 (165)	82.9 (150)	32.6 (61)	69 (120)	
The best fluid for my body is:					**0.001**
Correct	74.6 (144)	81.8 (148)	92 (173)	80 (140)	
Incorrect	25.4 (49)	18.2 (33)	8 (15)	20 (35)	
Juice & soft drinks cause dental caries					**<0.001**
Correct	73.6 (142)	72.2 (130)	94.1 (177)	71.3 (124)	
Incorrect	26.4 (51)	27.8 (50)	5.9 (11)	28.7 (50)	

** p value significant at p < 0.05. Values derived from Chi-square tests for all the variables*

Table 5.14 (continued) : Knowledge questions breakdown for intervention Vs. controls at baseline and post-intervention

	Baseline		**Post Intervention**		
Knowledge question	**Intervention (n=193)**	**Control (n= 181)**	**Intervention (n=193)**	**Control (n=181)**	***P*** *** value**
	% (n)		**% (n)**		
Chocolate & candies cause dental caries					
Correct	92.7 (179)	91.1 (164)	93.1 (175)	93.1 (161)	**0.994**
Incorrect	7.3 (14)	8.9 (16)	6.9 (13)	6.9 (12)	
Which of these foods have less fat: Fried potatoes/baked potatoes					**0.001**
Correct	41.5 (80)	61.1 (110)	76.5 (143)	60.3 (105)	
Incorrect	58.5 (113)	38.9 (70)	23.5 (44)	39.7 (69)	
Which of these foods have less fat: Croissant/corn flakes					**<0.001**
Correct	49.7 (96)	50.8 (91)	75.7 (140)	46 (80)	
Incorrect	50.3 (97)	49.2 (88)	24.3 (45)	54 (94)	
Which of these foods have less fat: Chips/pop corn					**<0.001**
Correct	49.7 (96)	55.8 (101)	68.8 (128)	42.1 (72)	
Incorrect	50.3 (97)	44.2 (80)	31.2 (58)	57.9 (99)	
Which of these foods have less sugar: Soft drinks/Milk					**0.003**
Correct	79.3 (153)	65.2 (118)	84 (158)	69.4 (120)	
Incorrect	20.7 (40)	34.8 (63)	16 (30)	30.6 (53)	
Which of these foods have less sugar: Doughnuts/fruit salad					**0.008**
Correct	67.4 (130)	71.5 (128)	79.2 (149)	65.6 (111)	
Incorrect	32.6 (63)	28.7 (51)	20.7 (39)	35.5 (61)	

** p value significant at p < 0.05. Values derived from Chi-square tests for all the variables*

Table 5.14 (continued): Knowledge questions breakdown for intervention Vs. controls at baseline and post-intervention

Knowledge question	Baseline Intervention (n=193)	Baseline Control (n= 181)	Post Intervention Intervention (n=193)	Post Intervention Control (n=181)	*P* * value
	% (n)		% (n)		
Which of these foods have less sugar: Fresh juice/tang artificial juice					**<0.001**
Correct	67.9 (131)	66.5 (119)	82.4 (155)	62.1 (108)	
Incorrect	32.1 (62)	33.5 (60)	17.6 (33)	37.9 (66)	
For my health, I should exercise…					**<0.001**
Correct	74.1 (143)	77.8 (140)	83.5 (157)	58.6 (102)	
Incorrect	25.9 (50)	22.2 (40)	16.5 (41)	41.4 (77)	

** p value significant at p < 0.05. Values derived from Chi-square tests for all the variables*

Analyses were also conducted using Generalized Estimated equations (GEE) to account for clustering. The trend in changes for the knowledge and self-efficacy scores remained significant. The knowledge score increased by 2.86 units (p<0.001) when comparing students in intervention group to students in control group at post-test. The self-efficacy score increased by 2.15 units (p<0.001) when comparing students in intervention group to students in control group at post-intervention. (Table 5.15)

<u>Table 5.15:</u> Coefficients for change in knowledge and self-efficacy scores in intervention versus control students, at post-intervention, controlling for baseline measures*

Score	Coefficient	95% CI	*P* value**
Knowledge score	2.86	1.7; 4.0	<0.001
Self-efficacy score	2.15	1.47; 2.82	<0.001

** Baseline measure refers to the response provided at pre-intervention.** Significant at p <0.05*

- <u>Health beliefs:</u>

  Students' health beliefs at baseline and post-intervention are presented in Table 5.16 for both intervention and control students. There was no difference in health beliefs at baseline between intervention and control groups. Fifty per cent of students believed food affects their health, more than 70% believe people who weigh more may have health problems and more than 60% believe that the food they were eating are healthy.

Table 5.16: Frequencies of students' beliefs at baseline and at post intervention

Health Beliefs	Baseline		Post Intervention		
	Intervention	Control	Intervention	Control	*P value*
	(n=193)	(n= 181)	(n=193)	(n= 181)	
	% (n)		% (n)		
The food I eat can affect my health					< 0.001
Yes	49.2 (95)	50.8 (91)	70.7 (133)	49.4 (86)	
No	26.9 (52)	24.6 (44)	16.0 (30)	22.4 (39)	
I don't know	23.8 (46)	24.6 (44)	13.3 (25)	28.2 (49)	
People who weigh more may have health problems					0.11
Yes	75.6 (146)	81.6(146)	82.4 (154)	69.5 (121)	
No	5.7 (11)	5.6 (10)	6.4 (12)	8.0 (14)	
I don't know	18.7 (36)	12.8 (23)	11.2 (21)	22.4 (39)	
The foods that I eat now are healthy					0.38
Yes	66.8 (129)	71.9 (128)	81.4 (153)	81 (141)	
No	7.8 (15)	10.1 (18)	7.4 (14)	4.6 (8)	
I don't	24.4 (47)	18.0 (32)	11.2 (21)	14.4 (25)	

** p value significant at p < 0.05. Values derived from Chi-square tests for all the variables*

Changes in Health beliefs: Table 5.17 compares students' health beliefs post intervention between groups controlling for their answers at baseline. The odds ratio for health beliefs on whether the food the student eat can affect their health was 2.7 times in the intervention students compared with control students (OR=2.74; CI= 1.4; 5.4; p=0.003). There were no significant changes in the questions of whether the food they are eating is healthy, and if people who weigh more may have health problems.

Table 5.17: Odds ratio comparing health beliefs in intervention versus control groups at post-intervention, controlling for baseline measures*

Health belief	Odds Ratio	95% CI	*P* value**
The food I eat can affect my health.	2.74	1.4; 5.4	0.003
The foods that I eat now are healthy.	2.15	0.88; 5.26	0.092
People who weigh more than they should may have health problems.	1.12	0.74; 1.68	0.595

** Baseline measure refers to the response provided at pre-intervention. ** Significant at p <0.05*

5.3.5 Students' anthropometric indices at baseline and post intervention

Table 5.18 describes the anthropometric data of the groups at baseline and post-intervention for both genders.

The sample's body composition (height, weight, BMI, waist circumference) was similar in both groups at baseline. There was no significant difference between BMI changes at post-intervention in either group.

Table 5.18: Anthropometric data at baseline and post intervention by gender for intervention and control students

	Mean ± SD Baseline		Mean ± SD Post Intervention		Mean change± SD		
	Intervention (n=193)	Control (n= 181)	Intervention (n=193)	Control (n=181)	Intervention (n=193)	Control (n=181)	P * Value
Weight (kg)							
Male	41.8 ± 12.2	38.1 ± 9.7	42.6 ± 12.3	38.4 ± 9.8	0.8±1.6	0.3±1.8	0.03
Female	39.1 ± 10.8	36.6 ± 9.3	40.4 ± 11.6	37.1 ± 9.2	1±3.4	0.5±1.4	0.27
Total	40.7 ± 11.17	37.4 ± 9.5	41.7 ± 12.0	37.8 ± 9.5	0.9 ± 2.8	0.4 ± 1.6	0.04
Height (cm)							
Male	143.1 ± 8.8	140.7±7.9	143.3 ± 9.0	140.7±7.9	0.2±0.5	0.0±0.1	0.01
Female	141.4 ± 7.8	139.6±9.2	141.6 ± 7.9	139.6±9.2	0.2±0.5	0.0±0.0	0.00
Total	142.4 ± 8.5	140.2±8.6	142.6 ± 8.5	140.2±8.6	0.2±0.5	0.08±0.08	0.00
BMI							
Male	20.0 ± 4.1	19.1 ± 3.7	20.4 ± 4.1	19.2 ± 3.6	0.3±0.8	0.1±0.8	0.06
Female	19.3 ± 10.3	18.6 ± 3.3	19.9 ± 4.3	18.8 ± 3.3	0.4±2.2	0.3±0.7	0.51
Total	19.7 ± 4.0	18.8 ± 3.5	20.2 ± 4.2	19.0 ± 3.5	0.37 ± 1.5	0.19 ± 1.5	0.15
Waist circumference (cm)							
Male	71.8 ± 11.1	68.8 ± 9.8	73.0 ± 11.1	69.4 ± 9.7	1.3±3.4	0.6±2.8	0.13
Female	69.7 ± 10.3	68.2 ± 9.5	70.3 ± 9.9	68.8 ± 9.7	0.6±3.6	0.6±3.9	0.99
Total	70.9 ± 10.8	68.5 ± 9.6	71.9 ± 10.7	69.1 ± 9.6	0.97 ± 3.5	0.59 ± 3.3	0.27

** p value significant at p<0.05. Values derived from independent t-test for all variables*

5.4 Qualitative data

As discussed in chapter 4, parents, students and teachers' group discussions were held separately. Accordingly, the focus group discussions results are presented for each group individually. The findings from all groups will be reported under four themes: the overall perception of the participants at the end of the programme, namely the acceptability of the programme and the awareness gained; students, parents and teachers views concerning the children's dietary and physical activity habits; the influence of the home and school environment on children's behaviours, and participants' suggestions to improve the programme.

5.4.1 Findings from the Students group discussions

Findings from the five focus groups carried out with students are presented in this section. Two of the focus groups were conducted in public schools and three in private schools. Each focus group consisted of eight to ten students.

Students' overall perceptions at the end of the programme

Students from all focus groups acknowledged that the programme helped increase their nutritional knowledge especially in the absence of other forms of nutrition education in the school curriculum. Most of the students were able to cite, in their own words, the main messages received during the educational sessions especially:

The importance of "eating more fruits and vegetables", the need "to have three meals a day"; why we should "decrease nibbling between meals and have a healthy sack instead"; among drinks ''water is the best"; we can "bake food instead of frying it, and it would still taste good"; how to "have less high sugar foods and soft, sweetened drinks, and less fatty foods".

One of the groups remembered most of the educational lessons almost six months following the intervention programme.

Students mentioned their enjoyment and excitement during the sessions and mainly the activities where foods were involved. Each group had a preferred set of activities, the below were cited by all the groups as their favourite sessions:

- Mr Cocktail – Fruits and vegetable activity
- Pedometer workshop – Exercise activity
- Traffic lights game – Energy dense versus nutrient dense foods activity
- Yummy breakfast – Breakfast activity
- Treasure game – Foods high in fats and sugars activity
- Food counter box – Food portions of food groups activity
- Snack attack – preparation of healthy snacks and drinks

Students' views concerning their dietary habits

Students reported making several attempts to bring changes to their dietary habits. Examples of some of these changes include eating less sweet foods and drinks as well as less chips and fried foods:

> I am eating 2 bags of chips instead of four and one candy bar instead of three a day (boy, group 2, private school)
>
> I used to drink soft drinks with every meal, now I am having only half a cup a day (girl, group 2, private school)
>
> I am buying less soft drinks and candies from the shop; I used to do it every day (boy, group 4, public school)
>
> The other day I was telling my diabetic uncle to stop drinking soft drinks, each can contains 8 spoons of sugar (boy, group 4, public school)
>
> I am asking my mom to bake food instead of frying (girl, group 1, private school)

A few children admitted that it is difficult to completely stop eating high fat and sugar foods and beverages, as 'they taste very good" and it's hard to give up certain habits such as "eating chips every day and having sweet drinks with the meals".

Efforts to increase fruits and vegetables intake were also noted. Some students did not like fruits and vegetables at all. They were trying to eat more portions a day especially fruits as a snack, although they still faced problems with vegetable intake. Students also mentioned being encouraged by their parents to eat more vegetables:

> I used to dislike fruits and vegetables, now it is better; I am able to eat some varieties (boy, group 4, public school)
>
> I don't like salads, but my mom puts a little and I eat it (boy, group 4, public school)
>
> I used to refuse to eat vegetables at lunch and order a Hamburger instead, now I try to add colours to my burger with some vegetables (girl, group 1, private school)

Breakfast intake was also among the healthy changes made to their dietary habits; "Waking up early" and "not having time or appetite to have breakfast" were among the barriers students tried to overcome in order to have breakfast on regular basis.

One of the skills that students mentioned learning was substituting favourite unhealthy food options with healthier ones they also liked. Knowing that some of their favourite foods were healthy, encouraged them to give up the less healthy ones:

> I am eating nuts and corn flakes instead of chips (girl, group 3, private school)
>
> I am drinking orange and blueberry juice instead of sweet and soft drinks (boy, group 1, private school)

Children were aware that the school shop was a problem, having chips and sweet drinks available everyday was considered "a big temptation, hard to resist"; students insisted that they would buy healthy snacks if those were available at the shop:

> I suggest closing the school shop, this way we won't be tempted to buy junk food (boy, group 4, public school)
>
> They should stop selling chips and soft drinks in the school shop (boy, group 5, public school)

> If the school shop offers fruits and fresh fruit juices I would buy instead of sweet drinks (girl, group 2, private school)
>
> I think it's a good idea to sell milk, yogurt, sandwiches made with freshly baked bread (girl, group 5, public school)

Students' views concerning their physical activity habits

Physical activity responses differed between girls and boys. Many girls admitted having no interest in exercise, but were doing more physical activity after the intervention, such as walking, running and using the jumping ropes given during the sessions. Boys expressed their frustration for not being allowed to play ball games during recess at school. However, some reported watching less TV and spending less time playing computer games; instead they went playing football or basketball whenever it was possible:

> I am playing football and basketball daily with my neighbours after I finish my studies (boy, group 5, public school)
>
> I used to stay a lot in front of the TV, now I go play football near my house (boy, group 2, private school)

The students unanimously agreed that the pedometer workshop was an incentive to move more. They all used the pedometer given during the sessions while playing at home or during the recess. A lot were disappointed because they lost it, it broke, or their siblings took it away.

> It was very exciting to try to reach the recommended steps per day (girl, group 3, private school)

Students' thoughts on the influence of the home environment

At home, children were trying to reproduce what they have learnt in class. When asked about recipes prepared at home, students confirmed that they were more confident in preparing healthy snacks and drinks. Some were encouraged by their parents and received help from their mother or older sister. Most of them tried the yoghurt smoothie prepared in class; a few added to it avocados or other types of fruits. Girls were proud to be able to prepare breakfast for all the family during weekends.

Students were as well preparing salads with less mayonnaise, and making their own fruit juices and mixes.

> I am preparing carrot and apple juice (girl, group 3, private school)
>
> Try the “Melted lemonade”: you put ice cubes, water, lemon juice and mint with a little bit of sugar in the blender. It’s very yummy (boy, group 3, private school)

A lot reported making healthy sandwiches using labneh (strained yogurt) and cheese instead of ham:

> Ham is not healthy; it contains a lot of fat (girl, group 4, public school)

<u>Students’ suggestions to improve the programme</u>

Students in all groups expressed their wish to participate again in the project and that they would recommend it to their friends:

> My brothers and cousins liked the programme; they’re following it with me at home (boy, group 5, public school)

Most mentioned the duration of the programme as being “too short”, the majority preferred to have sessions all year long and not just for three months.

> If you come all year long we won’t forget the good habits (All groups)

The students suggested including more games and activities in the intervention “although there were plenty of them”, but they felt the more play the better as opposed to the abundance of studies in the school curriculum. They also advised to increase physical activity sessions in the programme since the school curriculum provides only two per week.

5.4.2 Findings from the Parents' group discussions

Findings from the five parent focus groups are presented in this section. Two of the focus groups were conducted in public schools and three in private schools. Each focus group consisted of 5 to 6 parents.

Parents' overall perceptions at the end of the programme

Parents expressed their joy and appreciation for the programme; according to them school is the best place to start educating children about good nutritional habits. They commented significantly that Lebanese school curriculum does not cover this issue properly.

After the sessions, parents noticed that the children had received very clearly the educational messages given in class. Their children were explaining to siblings about the programme, giving advice to their mother and encouraging all members of the family to follow the messages given in class:

> One day, my son grabbed his diabetic uncle and showed him on the pamphlet you gave him, how much sugar there is in a can of soda (mother, group 4, public school)
>
> I had the impression that I was talking to a grownup (mother, group 2, private school)

Parents recognized that positive messages about food choices, such as moderation, with no "bad or good food labels" encouraged children to adopt healthier lifestyles. The students also learned about food choices and alternatives in essential and noncore foods:

> The most important thing they learned is how to choose among healthy food some alternatives that they liked (mother, group 3, private school)
>
> They liked the idea that nothing is forbidden as long as they eat the right servings of each food (mother, group 1, private school)

Parents reported that children enjoyed the programme, looking forward to every session and did not want to miss school on the day of the intervention.

> My child wanted to go to school while sick (high fever), she told me: today we have Miss Carla (mother, group 5, public school)

> Children were happy and enjoyed the sessions; the information was stuck in their head (mother, group 5, public school)

According to parents the interest of the students came from the fact that the programme was not a lesson to memorize, the games and activities encouraged them to learn and change habits. They knew about some nutritional value of foods but did not implement before, now they do. They were also referring regularly to the take home pamphlets given in class and many reported fixing them on the fridge at home.

> Great material: No books, pamphlets and booklets instead. Games, tokens, colourful and attractive (mother, group 2, private school)

> Sessions and lessons were not graded, kids hate grades (mother, group 3, private school)

> Don't know what you used or what was the method, but my boy was interested (father, group 3, private school)

Parents' views on their children's eating habits

Parents were happy to note that their children were trying more varieties of foods and accepted to eat foods they used to refuse to try such as fruits and vegetables, dried fruits, and fruit smoothies. Objections over food varieties offered at home also decreased. On the other hand, some parents still face problems with vegetable intake; they think their children still do not eat enough vegetables.

> My boy used to hate peas and green beans, now he accepts to eat from time to time (mother, group 1, private school)

> I used to ask him to try dried fruits, he never accepted, but when you brought dates to class and he tasted them he told me: mom I was wrong (mother, group 2, private school)

> He prepared the yoghurt smoothie he learned to do in class and made us all taste it (mother, group 4, public school)

> He prepared the healthy ‘Fanta’ – sparkling water with fresh orange juice- he tasted in class, he said it tasted better than other soft drinks (mother, group 5, public school)

Concerning the foods bought from school shop, the parents explained that children love to buy junk food, for the pleasure of buying, and it was not possible for them to refuse to their children some pocket money. However the children’s frequency of buying junk food such as chips and soft drinks decreased from school shop:

> My child was asking less frequently for pocket money. He was not buying from shop as before (mother, group 5, public school)

> My son bought for the first time plums from the neighbourhood shop instead of chips (mother, group 4, public school)

They also went shopping with their parents more often, asked for more vegetables and other healthy foods such as whole grain bread.

> My daughter asked for whole wheat bread, she said she’ll get used to the taste(mother, group 3, private school)

The parents also noticed other healthy habits such as brushing teeth regularly, correcting the way parents brushed their teeth, counting the portions, recognizing high fat foods, drinking natural juice and sparkling water instead of sweet drinks and having breakfast more often. Some parents also noticed a decrease in the weight of their children during and after the intervention.

<u>Parents’ perceptions of their children’s physical activity</u>

Most of the parents agreed that the Pedometer workshop encouraged children to exercise especially with the ones who did not like it: more walking, at home and during weekends, on balcony after school, using the stairs instead of the lift. All family members borrowed the pedometer and used it at home and outside.

> When he came back with the pedometer, he started taking the stairs instead of the lift to increase the score on his machine (mother, group 2, private school)

> His brothers and sisters were fighting over the pedometer (mother, group 1, private school)

The increase in physical activity was also noticed when the students received their giveaway gifts: balls and jumping ropes. However, the use of these tokens decreased with time, although they kept them with their personal belongings.

Parents noted that boys are usually more active than girls, even though they believe that with the widespread availability of electronic games, boys are getting less fit.

Sports as an extracurricular activity was viewed by many parents as a burden; they stated that it is not always possible to take children to participate in sports sessions as an after school activity because of time and budget constraints.

> I don't have time to take him to a sports activity afterschool: I come back late from work (mother, group 3, private school)
>
> Once they have finished their homework it is too late to do any sports activity. We don't have sports clubs in the neighbourhood (mother, group 4, public school)
>
> Physical activities outside school need time and dedication. This is difficult to find in my busy schedule and family duties (mother, group 2, private school)
>
> We need to allocate a special budget for after school sports. Activities and sports memberships are costly (mother, group 5, public school)

Parents from low income families, with no computers at home, reported that their kids were exercising more frequently, especially when they lived next to a playground or an open space.

<u>Parents' perceptions of the influence of the programme on the home environment</u>

Parents were influenced by the programme to create a more positive home environment. They made a lot of changes in cooking methods; they were using less fat and substituted oil for butter and margarine in recipes. They started grilling and baking foods instead of frying: baked potatoes, grilled meat and chicken.

They also introduced some changes in shopping; some mothers used to buy chips and candies in bulk, now they shop in smaller serving sizes, and started buying whole wheat breads and grains. According to most of the parents, it was not possible to stop buying chips and junk food; when the children do not find these foods at home, they go and buy them from the school shop or a shop near their home.

Parents noted that the programme sessions helped children become more involved in food preparation. They can now prepare healthy snacks and breakfast they learned to do in class alone; they find it easy and rewarding. The younger siblings copy their brothers and sisters in choosing healthy foods.

Some parents realized that before the intervention, although fruits were available at home, the children refused to eat them. But now, they do eat them.

Concerning screen time, parents have set specific schedules for TV viewing and electronic games, especially during school days.

<u>Parents' suggestions for improvement</u>

The need for a follow up with kids was a recurring topic in all focus groups. Children tend to forget overtime, follow up sessions would help maintain the positive behavioural changes acquired. Furthermore, the length of the programme was also mentioned as another limitation for better outcomes in behavioural change:

> If you keep on visiting for at least once a month they would remember and keep up the new acquired habits (All groups)
>
> Educational sessions should cover the whole academic year and all grades (All groups)

Most parents agreed that children accept advice and recommendations from teachers and educators more readily than from their parents:

> Try to find ways to convince children to buy less junk from school shop; this is one of the major problems we encounter (mothers, groups4&5, public school)
>
> Stress on activities that involve food tasting, especially fruits and vegetables (mother, group2, private school)

Parents' involvement was frequently mentioned during the conversation; ideas to improve attendance during parents' meetings were suggested:

> More meetings with parents: to avoid the poor attendance in parent's meetings, invite parents to workshops or activities prepared by their children (mother, group 1, private school)

> Involve the kids more, I came to this meeting and the previous one for the sake of my child who insisted that I attend (mother, group 1, private school)

5.4.3 Findings from the teachers' group discussions

Findings from the three focus groups and two in-depth interviews are presented in this section. Focus groups consisted of four to six teachers and were conducted at the private schools. In-depth interviews were held with the health educators at the public schools.

<u>Teachers' overall perceptions at the end of the programme</u>

Teachers agreed that nutrition awareness is necessary at the school level and should be part of any educational institution.

Science teachers noticed an increase in students' nutritional knowledge especially when compared to other classes not included in the intervention. The students learned new terms and skills: critical thinking, evaluation of food quality, food classification, food portioning:

> They were analysing food: healthy, less healthy, small or large portion (Teacher, group 3, private school)

> They were asking each other in the morning if they had breakfast (Teacher, group 3, private school)

> Once I came in without breakfast, they told me to leave and come back after having one (Teacher, group 2, public school)

According to teachers, the programme introduced new concepts and skills, corrected some of the students' nutritional misconceptions and benefited the children both at the health and educational level. The intervention reinforced and added to the information learned in Science classes.

They noticed that students enjoyed the intervention and the activities and were waiting eagerly for the weekly sessions. They were responding and interacting well during the sessions.

The teachers who attended most of the sessions acknowledged the fact that they benefited personally from the programme:

> The sessions you were giving were not lectures; the activities implemented gave the students new skills (Health Educator, public school)
>
> When the students are interested they learn more (Health Educator, public school)
>
> Hands on activities helped convincing the students with the information given in class
>
> They liked the sessions because it was not a lesson to memorize, though they memorized all messages (teacher, group 2, private school)
>
> Students were more organised than usual; they kept the file with them and had it ready on the day you usually come (Teacher, group 3, private school)
>
> I did not attend all sessions, but students were briefing me, and I was surprised with the amount of information they had grasped (Teacher, group 3, private school)

The Health fair activity that ended the programme and involved the parents and other peers was viewed by the teachers as a highly effective educational tool. The students were able to practise and demonstrate the new skills and information acquired during the sessions' programme:

> With the Health fair we were sure that the students mastered the info (teacher, group 3, private school)
>
> By presenting in front of their parents, the students acquired new skills (Health Educator, public school)

> The children were happy and proud to share their knowledge with younger students (Teacher, group 3, private school)

Teachers' observations regarding students' dietary behaviours

Teachers interact a lot with students during the day at school; they also take turns in supervising the children during recess. They noticed some dietary changes in foods bought from the school shop, mainly chips and soft drinks: students were buying less or in smaller packs. They also noticed less junk food and more sandwiches brought from home with some bags filled with cut vegetables:

> They stopped buying big bags of chips; instead they were choosing smaller ones and bringing sandwiches with them to school (Health Educator, public school)

> They were bringing corn flakes instead of chips and chocolate in their lunch box (Teacher, group 2, private school)

> I saw some students bringing carrots, lettuce, and cucumber in lunch boxes (Teacher, group 3, private school)

Teachers' observations regarding students' physical activity behaviour

The teachers noted several limitations towards students' physical activities: playgrounds in schools are very tight spaced, the number of PE classes in the curriculum is confined to only twice per week, and the sports activities that appeal to girls are limited. For example, dance or fitness classes are not offered.

This is why, activities such as the pedometer workshop motivated students in all schools to move more, especially the more sedentary children. The teachers noticed an important increase in walking, running and playing during the weeks of the pedometer workshop as well as with the give- away (balls, jumping ropes).

> When you gave them the pedometer, they spent the day jumping, even in class, to reach the recommended steps (Teacher, group 1, private school)

> They were coming up to my desk in class for no specific reason; I realized afterwards that they were wearing their pedometer (Teacher, group 2, private school)
>
> Students went crazy with pedometer workshop, did not leave it all week (Teacher, group 2, private school)
>
> The day you distributed the pedometer, it was the "No run day" policy during the recess, so they were jumping while standing (Teacher, group 1, private school)
>
> Pedometer caused a crisis in class; they were counting their steps all the day (Teacher, group 3, private school)
>
> Students cannot afford to buy a pedometer; it helped them realize how much they were moving (Health Educator, public school)

<u>Students' impressions as perceived by teachers</u>

Students were excited on the day of the intervention, and after each session they were giving positive comments. They mostly enjoyed activities with food experience, as well as the pedometer workshop.

They expressed their will to apply what they learned in class. Some were telling their teacher what they ate at home and the snacks and healthy drinks they were preparing. Students discussed in class each other's food intake, the changes made to their dietary habits, and what they had for breakfast.

<u>Teachers' insights on the influence of the school shops on students' behaviours</u>

The school shop or kiosk represents the only food service available in the school environment. School shop administrators in private schools cooperated well with the project and stopped selling chips and soft drinks. Teachers stated that rice and milk puddings, fruit pieces and cut vegetables were offered several times at the school shop during and following the intervention.

In public schools, teachers noted the lack of cooperation of the school shop administrator. In one of the schools, the health educator reported that the shop administrator even tried enticing the principal with free goods, and attempted to do the same with her. This shows the high level of influence that the school shop owners have on the final selection of food items in school shops. In the absence of any official legislation concerning foods sold at school shops, there would be no guarantee or enforcement that ensures availability of healthy food choices to students in school kiosks.

Teachers' suggestions for improvement

Teachers in all groups suggested extending the intervention to at least six months if not for the whole academic year.

> Children tend to forget, when you left they started forgetting some of the messages (all groups)

All agreed that integrating the intervention sessions in the existing curriculum was best for the success of the programme, putting fewer burdens on the schedule.

The problem of parents' involvement was raised; parents do not come to meetings at school as often as they should. They need more incentives to attend meetings in order to help at home.

Teachers expressed their willingness to participate in training workshops to be able to help in the intervention implementation. They think that their involvement is crucial for the sustainability of such programmes.

5.4.4 Main themes derived from the focus groups

The findings from the different focus groups conducted with students and their parents and teachers, suggested the following themes as major facilitators/contributors to the success of the intervention:

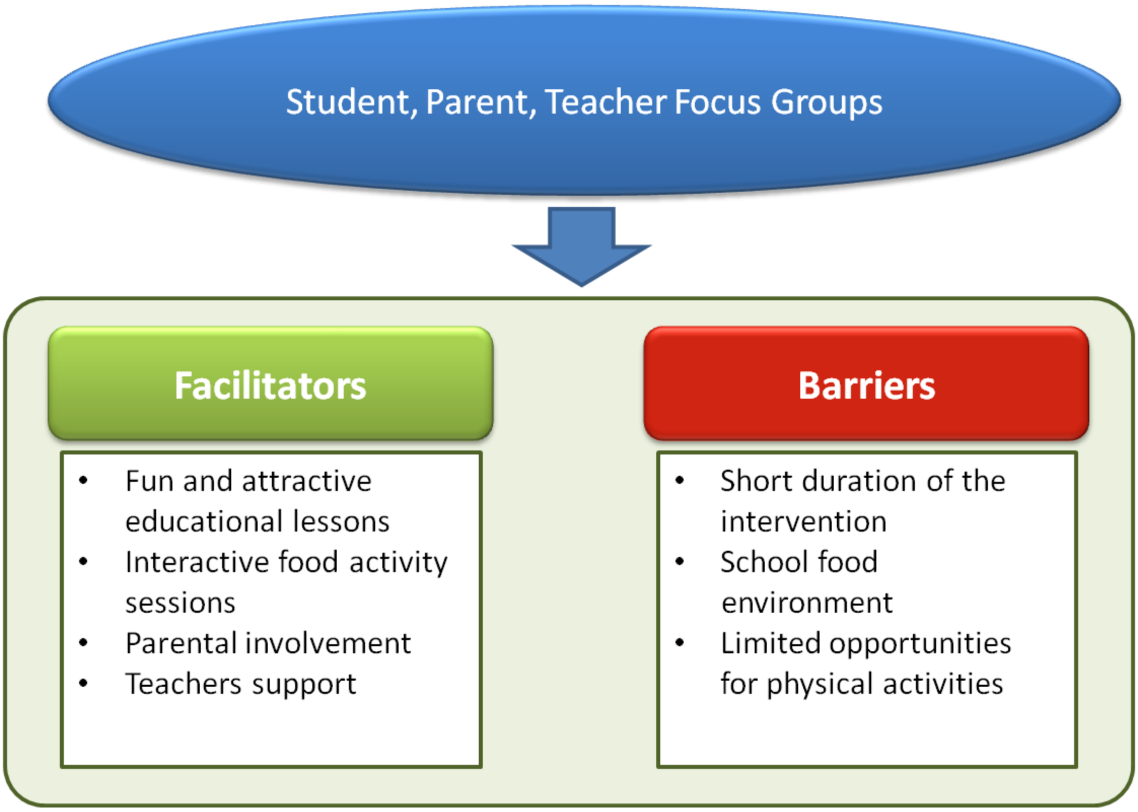
- Educational lessons that include attractive and fun activities that helped increase students' knowledge and skills in an enjoyable way.
- Active involvement in food activities/preparation that increased students' skills and self-confidence in choosing and preparing healthy foods.
- Parental and teacher's involvement was key to the success of the intervention as this emphasized modelling of healthful behaviours.
- Reinforcements such as praise and tokens (balls, jumping ropes, pedometers...) helped in the acquisition of the desired behaviour.

Limitation to better outcomes included the following:

- The length of the intervention: three months, was considered by all groups as a short duration to expect major behavioural changes. The importance of follow up was also raised by the different groups for sustainability of the new acquired behaviours.
- Student environment: especially at school was considered as one of the barriers to sustained positive behaviours. Students were exposed to unhealthy food choices such as sweetened drinks and energy dense snacks, and fruits and vegetables were not available in school shops.
- Barriers to increased physical activity: include the small playground at schools and their unavailability near homes, as well as the high attractiveness of computer and video games.

Figure 5.2 summarises the major factors that affected the implementation of the present study as derived from the focus group discussions.

Figure 5.2 facilitators and barriers to the implementation of the present intervention based on students, parents and teachers' views and perceptions



5.5 Process Evaluation outcomes

The Health-E-PALS programme was successfully delivered as designed: the 12 educational lessons and activities were all implemented in the intervention schools along with meetings with parents and the food service management. The health fair was carried out in two out of the four schools as it coincided with the end of the school year and the start of the final exams.

Researchers in Lebanon face many challenges mainly related to the political situation and some issues with security in certain regions of the country. Since no similar research projects were conducted in the area, it was difficult to set benchmarks for what could be feasible and reasonable to accomplish. The researcher faced several challenges during implementation of the programme with school principals, teachers, parents, school shops and curriculum integration.

Field Challenges confronted at the school level

Despite the acknowledgement of the Ministry of Education of the importance of this study, the implementation of such an intervention was challenging. The duration of the intervention (3 to 4 months) and its different components were viewed by the schools administrations as uncommon and difficult to achieve. This required an additional effort to convince the school staff to undertake the intervention.

- The school principals' cooperation: some principals showed very high interests in the project and were very cooperative whereas others showed interest but no collaboration or support at all. This affected positively or negatively the whole implementation process.
- Curriculum integration: The integration of the sessions within the school curriculum was not successful in one school out of the four. The intervention material includes content that can be integrated into most classes, for their relevance to the topic, and ease of understanding by the students. This was outlined in more detail in Table 4.1. The school principal was reluctant to allow the intervention to substitute a math,

language or science class. Instead he preferred to give-up art and physical education classes only.

- Teacher attendance: Teacher's presence in class was very helpful during the session's implementation and for the follow-up during the rest of the week. During the few times where teachers were absent, the research team faced some problems in maintaining discipline in class which delayed activities' implementation.
- Teacher motivation: Teachers in public schools earn lower wages than those in private schools. This can impact enthusiasm levels and motivation given to the students while delivering the session. This should be taken into consideration for the sustainability plan that will be disseminated at a later stage.
- Social unrest in Lebanon: Extra sessions were necessary to make-up for the missed ones that were canceled due to unpredicted strikes and security events prevailing in the country. The researcher faced this challenge given the three months intervention period. Once the intervention is integrated into a full year curriculum, this matter would be resolved.

Challenges at the school shop level

During the interventions at the school shops, similar obstacles were faced in both public and private schools. Private school shops have however a better capacity to improve the service levels, due to the higher financial disposition:

- School Shop owners are primarily revenue oriented and lack health & nutrition awareness
- Limited space is allocated to the school shop making it less feasible to prepare fresh food on site, such as salads, cut fruits and fresh juices.

- Poor hygiene facilities such as the lack of refrigerators, table tops and sinks limited shop owner to extend their varieties of healthy and fresh foods. This was more pronounced in public schools due to their lower budgets.

Challenges with the parent meetings:

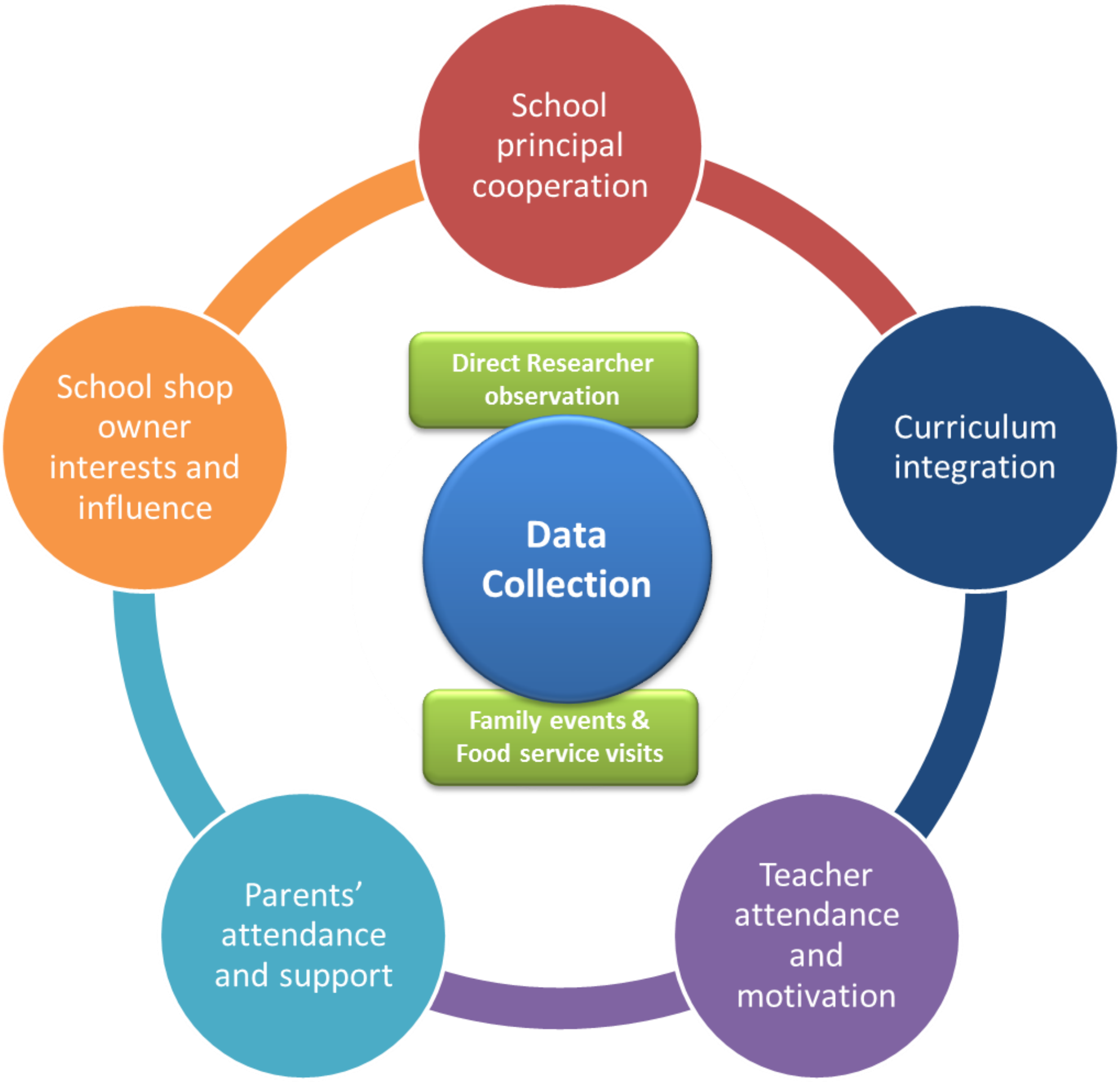
Gaps between socioeconomic classes and the level of education of parents entailed the need to adopt different approaches during meetings and interviews.

Parents' attendance to meetings was impacted by various factors:

- Both mother and father are working parents. This was more relevant in private schools
- Difficulty in arranging transportation to and from the school
- Younger children at home
- Poor parent and school coordination. Some parents were not well informed about the meeting or did not receive the invitation with all the right details from the school administration
- Parents personal perspectives, where some parents viewed the project as treatment for childhood obesity. They excused themselves from attending the parent meetings claiming that their children do not need to lose weight. As one parent put it: "my child is fit no need for a diet"
- Parents' presence was enhanced when they were given a direct motivation such as a breakfast meal, or gifts during the health fair.

Figure 5.3 summarises the process evaluation outcomes, with the data collection elements in the centre, and the challenges affecting the study implementation.

Figure 5.3 Process Evaluation outcomes of the present study



Chapter six: Discussion

'Health-E-PALS' is a school based programme for the promotion of Healthy Eating and Physical Activity in Lebanese School children. It is the first school intervention programme being implemented in Lebanese schools; the objectives of the study are summarized in Box 6.1. This chapter discusses the effectiveness of the programme that was based on the Social Cognitive Theory constructs and culturally favourable, on dietary, physical activity related behaviour changes and determinants of behavioural change. In addition to comparing the main outcomes with other published studies, this chapter describes the limitations of the programme along with suggestions for feasibility and sustainability in view of the roll out of such school based interventions.

Box 6.1 Summary of the study objectives

1. Develop a school-based multicomponent intervention that is theory-based and culturally favourable, focusing on: food consumption, physical activity, sedentary behaviours and involving parents and the school environment.

2. Test the intervention in four Lebanese schools.

3. Evaluate the effectiveness of the intervention on dietary and physical activity behaviour change, as well as determinants of behaviour change (knowledge, self-efficacy and beliefs) in school children.

6.1 The importance of theory and cultural sensitivity in the present study

6.1.1 The use of the Social Cognitive Theory as a childhood health promotion model in school settings

The current study was based on the Social Cognitive Theory constructs that offer standards on how to inform, facilitate, direct and motivate people to adopt healthy habits and reduce those that cause harm. The components incorporate the following: an informational element detailing benefits of acquiring the desired behaviour; the development of self-management skills and thus self-confidence in the desired behaviour; and social support mainly through modelling for the desired personal change *(Bandura, 2004).*

Most of the school-based interventions reviewed were developed based on some behavioural theory *(Sharma, 2006; Nixon et al, 2012; Waters et al, 2011)*, and the most popular was Bandura's Social Cognitive theory *(Shepherd et al, 2006; Sharma, 2006; Nixon et al, 2012).* Furthermore, studies based on the Social Cognitive Theory (SCT) had significant positive changes in one or several behaviour outcome *(Nixon et al, 2012).*

The major themes that mostly contributed to the positive effects of the 'Health-E-PALS' programme, as derived from the focus group interviews, were rooted around the Social Cognitive Theory constructs used to develop the intervention:

- The classroom based education component was described by students, their parents and teachers as fun, interactive and used innovative and attractive material to deliver information to students. The information was also shared with parents through meetings, booklets and pamphlets sent with their children. Informing children and their parents of the health benefits of a healthy diet and the risks associated with unhealthy eating behaviours, is essential in Bandura's SCT. Many other successful studies had also classroom-based components as part of the intervention programme *(Manios et al, 2002; Reilly et al, 2006; Kriemler et al, 2010; Caballero et al, 2003; Gortmaker, 1999).*

- Hands-on activities that included food preparation and tasting helped increasing students' skills in preparing and choosing healthy foods and recipes with their parents at home .That is in line with the construct of the SCT that emphasizes skills training as an important strategy to translate knowledge into effective practice *(Bandura, 2004).*Moreover, studies reporting significant results in weight, dietary and physical activity changes used also 'hands-on' learning *(Nixon et al, 2012).*
  - Parents, teachers and peers involvement was considered as fundamental to the success of the Health-E-PALS intervention. In Bandura's SCT, role modelling or observational learning, especially by important others, accentuates the acquisition of the desired behaviour *(Bandura, 2004).* Studies showing high parental involvement presented significant changes in one or more of the following: weight status, physical activity and dietary changes, and determinants of behaviour changes *(Manios et al, 2002; Reilly et al, 2006; Kriemler et al, 2010; Caballero et al, 2003; Gortmaker, 1999).*
  - Reinforcements used during the programme, such as praise and tokens, to reward students on the acquisition of a positive behaviour, helped increase their self-efficacy and confidence in their ability to choose and adopt healthy behaviours. According to Bandura, beliefs of personal efficacy and capability are considered a vital part in personal change *(Bandura, 2004).*

Recommendations from reviews of school-based interventions state the need for all interventions to be based on behavioural theories *(Sharma, 2006),* and to use strategies that increase students perception of competence at making healthy changes *(Nixon et al, 2012)*. Those strategies are in line with the present study's outcomes, as outlined by the qualitative results. They include developing skills, behavioural capability and self-efficacy, educating parents and teachers, and modelling healthful eating and physical activity.

6.1.2 The importance of cultural sensitivity

Recent reviews have suggested that effective interventions must be culturally appropriate *(Waters et al, 2011)*. The Health-E-PALS programme was tailored according to Lebanese and Arab culture. It featured traditional foods in all educational material and activities. Arabic was the main used language during sessions, meetings and on printed material. Rhymes and riddles specific to the Lebanese culture were developed and incorporated into the learning themes. As gathering around meals is one of the Lebanese cultures, parents meetings were held around breakfast where traditional Lebanese dishes were prepared and served in a healthy way. Several effective studies had also integrated cultural elements specific to the population under study, and this proved to be useful in reaching the desired outcomes *(Caballero et al, 2003; Robinson et al, 2003; Gutin, 2008; Spiegel & Foulk, 2006).*

There is a need for culturally appropriate nutrition promotion interventions for the prevention of obesity and its related health risk factors among Lebanese children. Educational programmes specifically developed for the Lebanese population are scarce. Most of the available material is adapted and translated from western sources.

The cultural aspect of the Health-E-PALS intervention facilitated meeting the objectives of the study. Students memorized the different health messages as these were recited in popular rhymes. Pictures and games featuring popular traditional foods (such as chickpea dip, tabouli, Arabic sweets and pastries, vine leaves...) helped children relate messages to their daily routine and foods available in their environment. Parents' invitations over breakfast helped secure better attendance, especially in public schools with families of low socioeconomic status. Focus group discussions revealed the enthusiasm of children while participating in the intervention. Parents and teachers believed that this was partly due to the attractive educational material which students enjoyed working with and easily related to. This was also reported by studies such as the Pathways and Sandy Lake *(Caballero et al, 2003; Saksvig et al, 2005)* where native learning styles were incorporated in the intervention curriculum. Authors concluded that increased exposure to a culturally adapted school-based intervention was associated with positive health related outcomes *(Saksvig et al, 2005).*

A recent review on the effectiveness of preventive school-based interventions in low- and middle-income countries found that contextual influences, such as social values and cultural norms, bring about changes in lifestyles that contribute to shape behaviour in children *(Verstraeten et al, 2012)*. Authors suggested that intervention activities aimed at changing the relevant outcomes be tailored according to the participants' context.

6.2 Diet related behaviour changes

A high proportion of Lebanese children consume elevated levels of fat, saturated fats and sugar coupled with low intakes of dietary fibres *(Nasreddine et al, 2012a).* Furthermore, as they hit adolescence, Lebanese school children suffer from low prevalence of appropriate dietary behaviours *(WHO, 2011).*These are characterized by low consumption of fruits and vegetables with a decreasing trend as they get older and high prevalence of fast food and sweetened drinks consumption. Skipping meals, mainly breakfast, is also common among Lebanese children and adolescents. The following sections discuss the effectiveness of the Healthy-E-PALS intervention on several dietary behaviours.

6.2.1 Eating habits (Breakfast, eating out, eating in front of TV)

Breakfast intake:

In the present study, a third of the students reported not having breakfast regularly at baseline, both in intervention and control schools. The recent Global School Health Survey conducted in Lebanon *(WHO, 2011)* indicates that only 54% of students aged 13 to 15 years ate breakfast most of the time or always during the last 30 days. A recent study on the prevalence and determinants of overweight and obesity in Lebanese children showed that children aged 5-11 years who don't have breakfast regularly are more likely to be overweight or obese *(Nasreddine et al, 2012a).* Students who skip breakfast suffer also from dietary inadequacies 2 to 5 times more than those who do not *(Nicklas et al, 1993).*

The Health-E-PALS study was effective in increasing daily breakfast intake in intervention students. Quantitative results showed that the odd for having breakfast daily for an intervention student was 3.5 times that of a control student. Results from focus group interviews confirmed that breakfast intake was among the healthy changes students made to their dietary habits; they reported trying to "wake up early" and overcome the lack of time or appetite in order to have breakfast on regular basis. Parents also noted that their children were preparing breakfast more frequently, following the examples given during the class sessions.

Teachers reported as well being questioned by their students if they had breakfast prior class sessions. This is in line with the systematic review within the ENERGY project on family and school-based correlates of energy balance-related behaviours that found that teachers could play a role in encouraging breakfast intake among 10-12 year old children *(Verloigne et al, 2012)*. Accordingly, interventions to promote breakfast consumption among children could possibly be successful when conducted in schools.

Moreover, the results of a recent review from 16 studies in Europe suggested that eating breakfast is related to decreased BMI among children and adolescents and associated with a reduced risk of being overweight or obese *(Szajewskaa and Ruszczyńsk, 2010).*

Young people are more likely to skip breakfast than any other meal. In the present study the per cent of students skipping breakfast (30%) was higher compared to the percentage of students skipping lunch (8%). Given the evidence that breakfast skipping increases with age *(Pearson et al, 2009; WHO, 2011),* interventions such as the Health-E-PALS proved to be effective in increasing daily breakfast intake among 9-11 year old children.

<u>Eating out:</u>

Various studies have shown that eating outside home has been increasing among children and adolescents, and especially at fast-food restaurants *(French et al, 2001; bin Zaal et al, 2009; Musaiger, 2011).* Data from the recent Global School Health Survey in Lebanon *(WHO, 2011)* show that about 20% of adolescent students ate food from a fast food restaurant such as KFC, Burger King, and McDonald's on three or more days during the week. Eating out has been associated with higher intake of dietary fat and energy compared to eating at home *(Guthrie et al, 2002).* In the Middle East region, frequency of eating fast-foods was found to be significantly related to obesity in Emirati adolescent girls *(bin Zaal et al, 2009).*

In the present study, eating out included home delivery from fast food restaurants, as well as dine in. The percentage of students eating out more than three times a week was 15.7% and 17.7% respectively in intervention and control students at baseline. This percentage did not change significantly post intervention possibly due to parental influence, as children in Lebanon do not gain independence for eating out until they reach adolescence. The majority of students in the present study reported eating out once or twice a week, and mostly on week-ends. However, with the increasing trend of fast food consumption during adolescence, it would be vital to start interventions early in childhood to limit these behaviours later in life. This is further illustrated by the results of a systematic review that looked at young people's views and perceptions about healthy eating. The study found that adolescents associated healthy foods with parents, adults and home *(Sheperd et al, 2006),* while fast food was associated with friends, pleasure and social environments.

Eating in front of the Television:

Television (TV) viewing has been associated with childhood obesity in a number of epidemiological studies *(Robinson, 2001).* Increased dietary intake during viewing is one of the assumed means by which TV viewing increases childhood obesity *(Crespo et al, 2001).* Studies show that a significant proportion of daily energy intake is consumed by children while watching TV *(Matheson, 2004),* and children food choices worsen with increased frequency of TV viewing *(Marquis et al, 2005).*

This pilot study suggests that the Health-E -PALS programme may reduce the likelihood of children's eating in front of the TV, and this will be tested in the full trial. This is in accordance with recommendations for interventions that aim at reducing food consumptions while watching TV, as effective approaches to decrease children's energy intakes *(Matheson, 2004; Epstein et al, 2002).*

6.2.2 Fruits and vegetable consumption

The present study tested the effectiveness of the intervention on the habit of consuming fruits as a snack. 74% and 66% of students in intervention and control schools respectively, reported eating fruits at baseline. Odds for eating fruits in intervention students, at post-test, were 1.65 times that of control students, without reaching significance. Other studies also reported lack of increase of fruits intake and recommended that future interventions should aim better use of fruits as snacks, desserts and part of the meal *(Van Horn et al, 2005).* Reviews of Studies that demonstrated positive increase in consumption, noted that although change in fruit and vegetable consumption was statistically significant it was small compared to the required intakes *(Thomson and Ravia, 2011).*

For the past several decades, public health officials have asked for an increase in fruit and vegetable consumption by adults and children *(U.S. Department of Agriculture & U.S. Department of Health and Human Services).* The basis for the promotion of increased fruit and vegetable consumption comprise the possible reduction in risk of many chronic diseases including obesity *(Astrup et al, 2008; Ledoux et al, 2011).* Longitudinal studies on the effect of fruit and vegetable consumption and adiposity in childhood found mixed results. Only half of the studies found an inverse relationship between fruit and vegetable consumption and adiposity *(Ledoux et al, 2011).* Authors concluded that fruits and vegetables intake should not be targeted alone when aiming for obesity prevention among children *(Ledoux et al, 2011).*

Fruit and vegetable intake remain below recommended levels, in spite of proof of the health benefits of regular consumption *(Kimmons al, 2009)*. In Lebanon, a cross sectional national survey showed low intakes of dietary fibres among Lebanese children

(Nasreddine et al, 2012); moreover, only 27% of adolescent students meet the requirements for five servings of fruit and vegetables a day *(WHO, 2011).* Reviews show that behavioural-based interventions to promote intake of fruit and vegetables resulted in an average increase of 0.39 servings per day in children *(Thomson and Ravia, 2011).*

Accomplishing and maintaining fruits and vegetables intake at recommended levels requires strong behaviour interventions, such as intervention models based on the Social Cognitive Theory *(Thomson and Ravia, 2011; Reynolds et al, 1999).* Availability and motivation (self-efficacy, food preferences) were the constructs mostly determining fruit and vegetables consumption among children *(Reynolds et al, 1999).*

In the present study, behaviour constructs used from the Social Cognitive Theory influenced the efficacy of the intervention. Self- efficacy, skills and food preferences were enhanced through direct exposure to fruits and vegetables along with tasting and snacks preparation. Interventions with parents secured accessibility at home. Qualitative results from focus group interviews suggest that students were making more efforts to increase fruit and vegetables intake at home. Parents reported children being less resistant when offered fruits and vegetables, and students mentioned being encouraged by their parents to consume fruits and vegetables. The fruit and vegetable workshops (Mr Cocktail, snack preparation, yogurt smoothie) helped in achieving the targeted behaviour. Recently published Evidence-based recommendations for the development of obesity prevention programmes are also in favour of tasting sessions that involve new healthy foods and drinks *(Summerbell et al, 2012).* Parents insisted during group discussions on the importance of food tasting during classroom sessions as it encourages children to try new foods and overcome some aversions, especially to vegetables.

The Health-E-PALS interventions at the school shop level proved to be unsuccessful in certain schools. This was brought up during focus group interviews as one of the barriers to increased intake of fruit: lack of availability of fresh fruits and juices at the school shop. Students mentioned their willingness "to buy fruits and fresh juices if these were offered at the school shop". Availability of healthy foods at school was also pointed among the perceived barriers to eating healthy in studies looking at insights into children's views on food and nutrition *(Sheperd et al, 2006, McKinley et al, 2005)*. Lack of choice and poor availability of healthy foods in school canteens were among factors inhibiting the ability of children and youth to eat healthily. Availability and accessibility of healthy foods and drinks at school are among the general recommendations to be considered when developing obesity prevention programmes targeted at children *(Summerbell et al, 2012).* The school environment factor involved in the present study is discussed later in the chapter.

6.2.3 Soft drinks and Sweetened beverages consumption

The Health-E-PALS intervention targeted both the intake of soft drinks (carbonated beverages) and other sweetened drinks such as artificial juices prepared from fruit concentrates and sugar, and artificially flavoured drinks. The amount of sugar added in these drinks is equal to the amount of sugar in soft drinks and these are usually inexpensive compared to real fruit juices. A trend of substitution of soft drinks by such artificial juices is widely observed in Lebanese schools and homes as these drinks are marketed as juices and hold some marketing claims that may not be scientifically based. In the survey, soft drinks and artificial juices were separated given the context of the Lebanese market, related to the perceptions of the consumers towards soft drinks versus artificial juices.

The programme significantly decreased students' intake and purchase habits of soft drinks. The odds of drinking soft drinks as a snack, for students in the intervention group was 88% less than that of students in control group at post-test. It is also noted that the odds of buying soft drinks from the school shop decreased by 89% in intervention students compared to control. Artificial juices intake habits and purchase decreased by 53% and 60% respectively without reaching significance between groups. Other studies have also reported a decrease in soft drinks consumption but not in other sweetened beverages *(Sichieri et al, 2009)*. The lack of significance in the artificial juices consumption in the present study could be explained by the availability of these beverages at school shops and at home as a substitute for soft drinks. Parents and health educators have the belief that sweetened drinks are a healthier option than soft drinks. Even though our sessions emphasized added sugars in those types of beverages, it takes a lot of time to correct long acquired misconceptions.

Sweetened and soft drinks intake has grown tremendously in the past two decades, especially in developing countries *(Levy-Costa et al, 2005).* Almost 60% of adolescent Lebanese students drink carbonated soft drinks one or more times a day *(WHO, 2011)*. Substantial information support the fact that regular consumption of sugar-sweetened beverages contribute to weight gain and increase the risk of type 2 diabetes and metabolic syndrome *(Bray, 2009; Hu, 2009).*

Recommendations for future research indicate that efforts to reduce energy intake through liquids should target overall sweetened drinks consumption. The Health-E-PALS sessions increased students' skills and self-efficacy in choosing and preparing healthy drinks. This was discussed during focus group interviews with students and their parents. Students described their success in decreasing soft drinks consumption and their experience in preparing healthy drinks with little added sugars (melted lemonade, fresh orange juice, sparkling water with fresh juice).

Health organisations recommend no more than 10% of daily energy intake from free sugars intake *(WHO, 2003b).* On the other hand reducing easy access to energy dense drinks could limit the chances of overconsumption of free sugars *(Hill& Peters, 1998)*; moreover, studies indicate that limiting availability of soft drinks at school was associated with a 4% decrease in the rate of consumption *(Fernandes, 2008).* Similarly, school based education programmes discouraging children from drinking sweetened drinks proved to be successful in reducing the number of overweight or obese children in a school year *(James et al, 2004c).* Thus, interventions such as the Health-E-PALS, if sustained can be effective on the long run in reducing the consumption of overall sweetened drinks in school children.

6.2.4 Energy dense snacks consumption

The increase in the frequency of eating, namely snacking *(Piernas and Popkin, 2010)*, and the changes in the energy density of the diet have been lately suggested among the causes of the increased energy intake responsible for the observed growing epidemic of obesity in the world. The most common forms of energy dense snacks include candies, chocolate, salty snacks mainly potato chips and high fat baked goods (croissant, donuts, Lebanese pastry). Those are widely available in retail stores and school shops in Lebanon and are usually considered among children’s favourite food items.

The Health-E-PALS intervention effectively reduced students’ consumption and purchase of some types of energy dense snacks namely potato chips and chocolate. Students’ odds for consuming chips in intervention schools was 86% less than in control students, and the odds for buying chips was 84% less. A recent study involving three cohorts that included 120,000 persons found that the dietary factor with the largest association with long-term weight gain was the increase in potato chips consumption *(Mozaffarian, et al 2011).* The results in the present study are better than outcomes from others that reported mainly decrease in sweet foods and candies consumption *(Marcus et al, 2009; Fernandes et al, 2009).* A possible factor might be the educational sessions' games that emphasized added fats and sugars in the common energy dense snacks that students usually consumed.

Students odds for purchasing chocolate and biscuits was 71% less in intervention schools compared to controls, chocolate consumption decreased without reaching significance between groups. A probable reason can be games and activities that featured energy dense versus nutrient dense foods and snacks (the traffic light game), where chocolate was classified as providing more nutrients than potato chips (Chocolate in the orange light vs. chips in the red light category). Another possible effect of the intervention might be the improvement of the home environment. Parents declared buying and storing fewer quantities of energy dense snacks at home.

Creating a healthy school environment was successful in few schools, where the access to potato chips was restricted. However, it was more difficult to convince the shop staff to remove all types of sweets and candies. The same was reported in other studies *(Marcus et al, 2009; Fernandes et al, 2009).* Increasing number of unhealthy options in school canteens were also described as barriers to healthy eating from studies looking at parents' perceptions on healthy eating, activity and obesity prevention *(Hesketh, et al, 2005)*.

During the focus group discussions students reported buying less quantities of chips and chocolate (one instead of 3 or 4), as the intervention sessions promoted moderation and not deprivation. The children learned how to include all types of foods in their diet, including the energy dense snacks (referred to as Extra group in the intervention), in the appropriate amount of servings. This was conveyed by parents as one of the strength of the intervention: teaching children to incorporate their favourite snacks in the right proportions, without forbidding consumption. This is in accordance with studies reporting children's views about food and nutrition, where adolescent girls and boys noted that balance was an attractive and motivating message *(McKinley et al, 2005).* Balance meant to children that they did not have to eliminate "junk food" or favourite foods completely from their diet. McKinley et al. noted that this should be put in practise by this age group, and avoid the continual dichotomisation of foods as "good" or "bad" *(McKinley et al, 2005)*.

Studies have indicated that snacks consumed between meals by children are comprised of calorie dense foods *(Ng et al, 2011).* There are no national studies on snacking habits in Lebanese children; in the present study, a majority of students (97.9% and 96.7% in intervention and controls respectively) reported consuming snacks, with almost 44% consuming more than two a day. Programmes such as the Health-E-PALS can be considered promising in decreasing consumption of high energy dense snacks among 9-11 year old children.

6.3 Physical activity related behaviours

Regular physical activity is widely recognized as an effective measure to prevent a variety of health risk factors *(Janssen and Leblanc, 2010)*. However, physical activity remains low globally and among all age groups *(Colley et al, 2011; Troiano et al, 2008; Musaiger, 2011)*. The inactivity crisis is especially affecting the paediatric population *(Tremblay et al 2011),* as a very small percentage of youth meet the current recommended physical activity guidelines *(WHO, 2011).*

Intervention approaches that should be considered while developing obesity prevention programmes state that physical activity and dietary behaviours should be targeted together *(Summerbell et al, 2012).*

The physical activity element of the Health-E-PALS intervention consisted of two sessions that were incorporated during the regular physical education classes of the school curriculum. The sessions encouraged playful activities along with the promotion of 30 to 60 minutes of physical activity throughout the day and the decrease in sedentary behaviours. In the following sections, the effectiveness of the intervention on physical activity and sedentary behaviours are discussed.

6.3.1 Organised physical activity

Children spend a considerable amount of time at school, thus the school environment can have a potential influence on their physical activity behaviour *(Sallis et al, 2001)*. Lebanese school curriculum adopts two mandatory physical education classes per week in the elementary level. While the majority of students in the present study reported regular participation in the physical education classes, these remain far below the recommended 60 minutes of exercise a day. Only 40% of students reported engaging in after school organised physical activity 3 or more times a week. The intervention was not successful in raising organised sports to more than three times a week, but helped increasing the odds of students in intervention schools to engage in after school sports for at least once a week by 2.35 times.

Studies that showed positive results on physical activity included one or several of the following: enhanced physical education classes, additional physical educational lessons during school days, additional sport and play activities outside school hours, and presence of professional physical education teachers *(Luepker et al, 1996; Kriemler et al, 2010; Jansen et al, 2008; Slawta et al, 2008).* Due to time and school policy limitations it was not possible for the Health-E-PALS intervention to increase the number of structured, organised physical activity lessons during school hours.

Another explanation for the lack of positive results in organised physical activity stemmed from the focus group interviews. As children need parental approval for participating in after school sports, parents stated their reluctance to enrol their children in extracurricular activities. Reasons for that included budget, time, schedule constraints and homework overload. Lack of parent time and financial restraints were also reported in other studies as barriers to children participating in organised sports *(Hesketh et al, 2005)*.

Students, on the other hand, asked for more physical activity sessions to be included in future interventions since the school curriculum provides only two per week. They considered the more play the better as opposed to the abundance of studies in the school curriculum.

As School-based multicomponent physical activity interventions proved to be effective in improving fitness and reducing adiposity in children *(Manios, 1999; Slawta, 2008; Kriemler, 2010),* it becomes essential to use the school environment to promote physical activity.

Recommendations for increasing organised physical activities in schools comprise the addition of one or two physical educational lessons in the school curriculum, to reach a total of at least three per week. Other suggestions include extracurricular activities to be made available at school. Some Lebanese private schools do offer after school sports however at an extra cost and mainly once a week. Providing after school physical activities on several days of the week, at nominal fees and including activities that would appeal to girls is to be considered when developing future interventions and policies.

6.3.2 Unorganised physical activity

As the Health-E-PALS intervention had no influence on the physical education lessons in the school curriculum, the objectives of the sessions were to increase unorganised physical activity. Children have the possibility to engage in unorganised play at school during recess and at home if enough space and safety are available.

The Health-E-PALS sessions emphasized unorganised physical activity through several means one of which is the pedometer workshop. Pedometer-based interventions are becoming more popular as low-cost and effective method for promoting physical activity and increasing walking *(Chan et al, 2004; Croteau, 2004; Schofield et al, 2005).* In the present study the pedometer intervention proved to be successful in motivating children to move. Results from focus group interviews showed a unanimous agreement among students, their parents and teachers on the effectiveness of the pedometers as an incentive to increase daily physical activity. Walking is usually considered a boring activity by children, however with the pedometer use they noted that it was exciting and challenging to count their steps and try to reach the goal of 10,000 steps a day. Students were using the stairs instead of the elevators, going more often for a walk around the house and during recess at school. Other qualitative studies also found that pedometers are useful in setting goals and motivating participants to increase their physical activity *(Heesch et al, 2005)*.

Quantitative results from the current study showed that the odds for intervention students to play during recess were 1.4 times that of control students at post-test. This change was not observed at home, probably due to unsafe neighbourhoods and lack of appropriate places for exercising as explained by parents during focus group interviews.

Other strategies used during the Health-E-PALS intervention to increase unorganised play include interactive sessions and activities. Children learned to identify sedentary behaviours and were encouraged to increase their physical activity by recording these on special activity booklets sent with them at home. Praise and tokens (jumping ropes and footballs) were distributed to students as rewards for achieving their set goals. Parents noted that prizes motivated children to exercise more, especially jumping ropes with girls, as this is an activity that does not require extra space. Rewards for uptake of desired behaviour are considered as important approaches to consider and should be included when developing obesity prevention interventions *(Summerbell et al, 2012).*

Unorganised physical activity such as enjoyable play, walking and running proved to be successful in increasing children daily physical activity habits especially when sufficient organised sports are not available.

6.3.3 Sedentary behaviour (screen time)

The Health-E-PALS intervention was not successful in decreasing students screen time habits. As the popularity of electronic games increased among children and adolescents, ‘sedentary multitasking’ has become more common. On top of watching television daily, children are able to play on portable devices, talk on the phone and use the computer at the same time *(Tremblay et al, 2011).* Though Lebanon is considered a developing country, children have easy access to screen-based technology even in families with low socioeconomic status and no access to computer or internet. Children spend a considerable amount of time in internet cafes that proliferate widely in most neighbourhoods providing low cost internet access.

Several reports confirm that children spend the majority of their discretionary time engaging in sedentary leisure such as television viewing, computer and video games

(Colley et al, 2011; Leblanc et al, 2010; Musaiger, 2011). Mounting evidence shows that independent of physical activity levels, sedentary behaviours are associated with increased risk for many diseases and namely adiposity *(Treuth et al, 2007; Katzmarzyk et al, 2009; Owen et al, 2009).* A recent review of sedentary behaviour and health indicators in school-aged children suggests that children should watch less than two hours of television per day and reduce the time they spend playing computer and video games *(Tremblay et al, 2011).*The same review showed that intervention studies which helped children decrease their sedentary time reported desirable changes in body weight and BMI.

In the present study, parents believed that the widespread of electronic games is one of the causes of children's loss of fitness. This was also raised by a qualitative study on New Zealand parents' perceptions on children and television who perceived TV viewing and other electronic media as preventing their children from being physically active *(Dorey et al, 2009)*. Although for families included in the present study, there were strict rules restricting television viewing and video games during school days, this was not sufficient to induce significant changes in students' screen time habits. Findings from other studies reported that parents perceived reducing their children's TV viewing as a difficult task *(Dorey et al, 2009).* Current strategies employed by parents to control their children's TV viewing included limiting access to TV, making access a reward or providing alternative activities such as organised outdoor activities *(Dorey et al, 2009).*

Interventions showing similar lack of effect on screen time habits suggest longer duration follow-ups *(Harrisson et al, 2006).* Other suggestions include working around a reduction of some sedentary behaviour with a gradual decrease in the most sedentary group *(Tremblay et al, 2011).*Recently, active video gaming such as Nintendo Wii ™ and Sony's Playstation Move™ was advertised as an effective form of physical activity.

Studies demonstrated that some games do induce sufficient energy expenditure; however, it is still too soon to conclude that active video games can be an efficient physical activity on the long-term *(Biddiss and Irwin, 2010).*

As Lebanon is not exempt from the global inactivity crisis, interventions focusing on both decreasing sedentary behaviours and increasing physical activity should be developed. The Health-E-PALS intervention encouraged students to decrease sedentary activities through interactive sessions and games; however that was not sufficient to induce change. Public health initiatives and population-based interventions should be considered in order to counteract the health implications of sedentary behaviours especially on children and youth.

6.4 Outcome measures for determinants of behavioural change

The Social Cognitive Theory specifies a set of determinants through which effective health practices would occur. These determinants include knowledge of health risks and benefits of different health practices, perceived self-efficacy of the person's ability to control one's habits, and facilitators that will help in reaching the desired goals *(Bandura, 2004).* In the following sections, the efficacy of the study on knowledge, self-efficacy, role modelling and availability is discussed.

6.4.1 Children's nutritional knowledge

The Knowledge of how habits can affect health is the milestone for positive or negative behavioural change *(Bandura, 2004).* Unless people know how their lifestyle habits affect their health, they will not be persuaded to change the practice they enjoy. Nutrition education in grades 4 and 5 in Lebanese schools is important, though not sufficient to empower students to improve their diet. The Health-E-PALS educational element focused on increasing students' nutritional knowledge of commonly consumed foods and their effect on health. The programme was successful in significantly increasing students' nutritional knowledge in intervention schools compared to control. The students' knowledge score increased by 2.8 units in intervention schools whereas it remained unchanged in control, noting that both groups scored the same on knowledge at baseline. Several other studies found that nutrition knowledge improved in intervention groups following school-based interventions *(Lakshman et al, 2010; Saksvig et al, 2005; Manios et al, 2002; Warren et al, 2003; Amaro, 2006).* Some of the above mentioned studies used novel approaches in their educational component such as board or card games others developed work books and teaching aids specifically for the intervention.

The Health-E-PALS intervention combined several approaches within its educational component: card and board games, as well as posters, pamphlets and booklets exclusively developed for the programme. Group discussions with parents and teachers revealed that students' knowledge effectively improved due mainly to the colourful and attractive material used and the fact that the classroom component was an activity and not a lesson to learn as students loathed homework and grades. Even though the children did not have to memorize, prepare and practice at home as with conventional teaching, teachers, in particular science teachers noted that their students had grasped quite an amount of information. This further demonstrated the importance of interactive learning as an effective tool for increasing knowledge in children *(Nixon et al, 2012).*

While increasing knowledge may be an important initial step, it is not fully determined that improvements in knowledge alone can lead to changes in behaviours. A study on perceptions of healthy eating of school-age children in South India found that although children were able to distinguish between healthy and unhealthy foods, this knowledge did not translate into behaviour with less consumption of unhealthy foods *(Swaminathan et al, 2009)*. This is why additional self-influences are needed to empower children to adopt the recommended behaviours *(Bandura, 2004).* This is discussed in the next section.

6.4.2 Children's self-efficacy, skills and beliefs

Beliefs of personal efficacy are a fundamental part in personal change, as self-efficacy motivates people to act. Unless persons believe they can make needed changes to their lifestyle, they have little motivation to act or persist in the face of problems *(Bandura, 2004).*

Students exposed to the Health-E-PALS intervention scored significantly higher on self-efficacy scales compared to controls. The self-efficacy score increased by 1.7 units in intervention group and remained the same in control group at post-intervention. Self-efficacy was shown to be a constant determinant of behaviour across a variety of health fields including diet and weight loss *(Glynn and Ruderman, 1986).* Furthermore, self-efficacy was found to be an important intermediary of the relation between knowledge and behaviour *(Rimal, 2000).*

Hands-on activities included in the Health-E-PALS classroom sessions empowered children with the skills needed to increase their self confidence in their ability to adopt healthier behaviours. Students participated in recipe preparation workshops, learned how to plan healthy meals and played games that emphasized the adoption of healthy food and physical activity. As portrayed in group discussions, parents acknowledged the fact that their children were more confident while choosing and preparing healthy foods and drinks. Most of the students whose parents attended the focus group meetings tried one or several of the recipes prepared in class. The findings of the present study were in accordance with other school-based interventions which were also significantly associated with increased dietary self-efficacy among children exposed to the programme (*Saksvig et al, 2005).* Studies evaluating whether a mediating variable or determinant affects the outcome variable found that changes in self-efficacy were rather consistently related to changes in dietary behaviour *(Cerin et al, 2009)*.

6.4.3 Parental involvement and role modelling

Children learn about food not only through their own experience but also by watching others and mainly their parents. A growing bulk of research exposes similarities between parents' and children's food preferences and intake *(Fisher et al, 2002; Gibson et al, 1998; Tibbs et al, 2001; Patrick and Nicklas, 2005).* Parental involvement is the first step to building support of healthy behaviours in children as studies with high parental involvement reported positive results in one or more outcome measure *(Nixon et al, 2012).*

Parents' involvement in the Health-E-PALS intervention was through direct and indirect exposure to the programme's elements. Meetings and health fairs secured direct parents participation, indirect involvements was through packs sent home with children and communications directed at the child and his parents meant to involve parents in intervention activities such as recipes to try at home. A recent systematic review on parental involvement in interventions to improve child dietary intake found that although limited conclusions may be derived regarding the best method to involve parents, studies that used direct methods to engage parents proved to be more successful than those who used indirect methods *(Hingle et al, 2010).* In addition, studies using indirect methods but required parents participation in an activity reported also better outcomes.

In many low and middle-income countries, caregivers and families are more present in the daily life of children compared to high income countries *(Verstraeten et al, 2012)*. Parents helped in the success of the Health-E-PALS intervention by several means, of which was the availability and accessibility of healthier food options (whole grain products, low fat cooking, less energy dense snacks) at home. Another way by which parents supported the programme was through role modelling, as students reported being helped by their mother or elder sister in preparing healthy meals and being encouraged to consume more fruits and vegetables. This was also noted in a systematic review about young people's (11-16 years) views about healthy eating *(Sheperd et al, 2006).* Encouragements from the family were commonly mentioned by the youth among the facilitators and support mechanisms for healthy eating.

Unfortunately, parents' attendance during meetings was not up to the expectations in some schools. However this was partly compensated by invitations to participate in health fairs. The latter confirmed parents' advice given during focus groups: "in order to secure parental attendance for meetings, invite them to attend performances by their children". The same has been identified as a solution to barriers for parental involvement by other studies. Uninterested parents can be motivated to attend certain activities to please their children *(Pocock et al, 2010)*.

Rewards, incentives and democratic prices for activities were also amongst successful strategies to ensure parents participation in school events *(Pocock et al, 2010)*. This was also noted in the present study where provision of a meal such as breakfast and tokens and small prizes distributed during health fair games helped secure parents' participation.

A focus group research, part of the ENERGY project explored parents perceptions and views about parental involvement in school obesity prevention interventions *(Lippevelde* *et al, 2011).*Recommendations proposed by parents as best ways to engage them included interactive and practical activities such as cooking, food tasting, and nutrition workshops and sports activities that involved both the child and his parent. The above proposed activities ought to be considered in addition to the previous ones when planning for the future large scale roll out of the present trial.

Although parents have the strongest authority on children food choices, children are also influenced by what their peers eat. Birch found that when children saw others eating fruits and vegetables they didn't like, intake of disliked vegetable increased *(Birch, 1980).* This was also reported by parents in the present study during focus groups; Children were encouraged by their peers in tasting workshops at schools, to taste dried fruits and vegetables they used to refuse to eat. Studies involving peer-led teaching also proved effective in increasing healthy behaviours and attitudes in elementary school-children *(Stock et al, 2007).*

On the other hand, peer pressure can also exert a negative influence on children's eating habits. Parents reported that they were not able to prohibit their children from buying from the school shop when their friends were doing so. Peer pressure was also acknowledged as a major barrier to healthy lifestyle from other studies as well; enforcing healthy eating and limiting sedentary activities was viewed as difficult for parents when children wanted to conform to what their friends were doing *(Hesketh et al, 2005).*

The Health-E-PALS intervention combined both direct and indirect methods to involve parents and proved that studies promoting parental participation in school-based programmes in Lebanon can be achieved. Further research is needed in order to determine the best schemes by which schools and families can work together to accomplish children's healthy behaviour changes.

6.5 Availability or the role of the Obesogenic environment on the effectiveness of the intervention

Environments that promote high energy intakes and sedentary behaviour have been recently investigated as factors contributing to the global obesity epidemic *(Lake and Townshend, 2006).* Obesity promoting environments (Obesogenic environments) are identified to be a driving influence behind the growing obesity rates *(Swinburn et al, 1999)*. Swinburn and Egger defined the obesogenecity of an environment as 'the sum of influences that the surroundings, opportunities, or conditions of life have on promoting obesity in individuals or populations' *(Swinburn and Egger, 2002).*

Food environments and the ability of the environment to encourage physical activity are both closely related to health. The following sections discuss the school food environment and the physical activity facilities available to students at the time of implementation of the present study.

6.5.1 School food environment

Schools are a crucial part of the social environment that forms young people's behaviours *(Parcel et al, 1989).* The school environment can support or obstruct messages delivered through the health education curriculum and can promote or make obstacles to healthy behaviours *(Shilton and Corti, 1992).* There are no published data on how 'obesogenic' the school environments are in Lebanon, however, from interviews and observations conducted in schools in the present study, findings indicated that the school environment in Lebanon could be obesity-promoting.

The schools that participated in the Health-E-PALS intervention did not have canteens as is the case in the majority of Lebanese schools. The food service is mainly constituted of shops or kiosks. The food items most frequently sold were energy dense snacks and drinks as well as sandwiches and traditional pastries. However, fruits were not among items offered for sale and none of the schools operated a vending machine. It's worth noting that shops constituted an important financial factor to schools. Private schools ran it for profit for the school; public schools contracted it out to private business. Contracts are awarded at the beginning of the academic year, and the highest bidding party wins the tender.

Efforts to decrease availability of energy dense snacks and drinks were only successful in private schools; public schools principles were not able to enforce it to shop administrators as these argued profitability issues since they relied on snack foods, mainly chips and chocolate to boost revenue and be able to cover their expenses. Availability of healthy food items was not always implemented, fruits for example were offered only once in one of the private schools during the intervention.

Availability and accessibility of energy dense snacks and drinks in primary schools is not solely a Lebanese issue. A new study established that competitive foods (foods sold in vending machines and school stores) were widely available in elementary US schools *(Turner and Chaloupka, 2012)*. The study focused on snacks not sold during mealtimes, which until recently was not subject to government nutrition standards. The only regulation for competitive foods was that low nutrient items cannot be offered in cafeterias during lunch time, but can be sold freely in vending machines or school stores. Schools most likely to sell chips, cookies or similar foods were in the South where obesity rates are the highest *(Turner and Chaloupka, 2012).*

A new law enacted in December 2010 gave the US Department of Agriculture authority to set nutrition standards for all foods sold in US schools *(www.usda.gov).*

Another USDA change announced in January 2012 focused on making school lunches healthier including food items with less sodium and more whole grains.

A study also found that the food environment in New Zealand primary schools appeared to be “Obesogenic” and the authors felt the urgent need for policies that promote healthy food choices in schools *(Carter and Swinburn, 2004).*Similarly, in UK schools, a large variety of unhealthy options made it difficult for students to choose healthy foods *(Ludvigsen and Sharma, 2004).*

A recent review article on the effectiveness of school-based interventions in low- to middle-income countries found that changing the nutritional environment in schools poses a real challenge in these countries *(Verstraeten et al, 2012)*. The type and difficulty of changes necessary differs from those in high income countries, especially that sometimes, street vendors mingle with privately owned tuck shops *(Verstraeten et al, 2012).* The Ministry of Higher Education in Lebanon has recently issued a law restricting the sale of competitive foods in school shops and kiosks; this law has not been enacted on yet, waiting for approval of the Chamber of Deputies, the legislative authority in Lebanon. When this law will be enforced, there will be a chance to develop strong nationwide standards to improve the food environment in Lebanese elementary schools.

The findings of a recent study suggested that competitive food sale in elementary and middle schools was not associated with the growing obesity epidemic in childhood *(Van hook and Altman, 2012)*. Despite these results we cannot deny the fact that it is an utmost paradox to promote healthful eating in school curriculum while shops continue to sell competitive foods *(Bandura, 2004).*

6.5.2 Physical activity facilities

In Lebanon, except for school playgrounds, free physical activity facilities are scarce. At schools children and youths have the possibility to exercise during the physical education sessions and at recess if the playground is large enough. After school sports are offered in some schools for an extra fee or in private sports clubs usually at an elevated monthly membership cost.

Increasing expectations about academic achievements have prompted many Lebanese schools to cut back on both recess time and gym classes. When implementing the Health-E-PALS intervention, the school principals were more willing to exchange physical education classes for the integration of the sessions than any other as these do not jeopardize students' academic curriculum. With regard to physical activity during recess, playground equipment and space were not always adapted for children's active play. Focus group interviews revealed that for parents it was critically important that children get the physical activity they need during the school day. This was similar to the views of European parents who considered physical activity as a joint responsibility between school and parents *(Lippevelde et al.,2011).*

Another area of particular concern is the activity pattern of young girls. Teachers and parents noted that girls' physical activity participation is generally less frequent and of a lower intensity than that of boys. Concern regarding the physical activity levels of girls is not restricted to Lebanon, but is also the case in many other countries *(Grunbaum et al, 2004; Sallis et al, 2000; Taymoori et al, 2008).* Reasons could be cultural in some countries, as well as the lack of girls' interest in activities offered. Sports that appeal more to girls such as fitness and dance classes are rarely offered. Competitive sports, mainly ball games, are more emphasized during gym classes in primary and secondary Lebanese schools.

The built environment in urban areas such as the city of Beirut and its suburbs prevents children from engaging in spontaneous physical activity and play. The quality of pavements, footpaths, and perception of safety by caregivers do not encourage walking, cycling or active transport to and from school. There are only few shopping malls and streets in down town Beirut and by the sea side where walking can be considered safe, however, under the supervision of an adult. Safety concerns and the increasing distances between children's homes and schools were also cited as main barriers to physical activity in a qualitative study of parent and child perceptions on healthy eating, activity and obesity prevention in Australia *(Hesketh et al, 2005)*.

A body of evidence suggests that there is a link between the built environment, physical activity, obesity and chronic diseases *(Frank et al, 2006).* Efforts to improve the urban environments and increase pedestrian friendly neighbourhoods have been emerging in developed countries. Examples include 'Healthy Cities' Project launched by the World Health Organisation Regional Office for Europe and the Healthy Communities Movement and the Coalition for Healthier Cities and Communities in the United States *(Lafond et al, 2003; Norris and Pittman, 2000).* Improving the urban environments is not of Lebanon priorities since the main concern of policy makers is around economic and political problems, like other developing countries.

In view of the present study's findings with regard to physical activity facilities available to children, efforts should focus on improving the school environment as it was suggested to have a powerful influence on children's physical activity *(Sallis et al, 2001).* The best approach would be towards using the physical education curriculum as the central part for promotion of activity as well as to develop interventions aiming at encouraging exercise during break periods and after school for both girls and boys.

6.6 Changes in students' anthropometric indices

There were no changes in students' pre to post BMI and waist circumference measurements in the present study. This was probably due to the short duration of the intervention (12 weeks) and time between measurements, whereby, it is difficult to detect any noticeable changes in adiposity in such a short period of time.

Systematic reviews *(Waters et al, 2011)* showed that the majority of studies targeting six to 12 year old children that proved effective on some indicators of adiposity, involved long-term intervention periods (>12 months).

In addition, studies that positively impacted children's body composition were successful in including a physical activity component either within the school curriculum or as an after-school activity. The different physical activity components incorporated additional physical activity sessions *(Manios et al, 1999; Kain, 2004),* aerobic activities preceding intervention classes *(Spiegel et al, 2006)*, increase in non-curricular physical activity *(Taylor et al, 2008)* and after-school physical activity as well as active transport to schools *(Sanigorski et al, 2008).*This was not possible in the present study, where the physical activity component was limited to only two sessions.

However, even though the present intervention did not affect adiposity outcomes, it affected some of the targeted mediating variables, such as knowledge, self-efficacy and some behavioural variables such as consumption and purchase of high energy dense drinks and snacks. This provides some evidence about how this study worked and if replicated for a longer period of time it might be effective on some obesity indices.

6.7 Power calculation

The present research did not have a power calculation since it was a pilot study and the main objectives were to assess feasibility, efficacy and overall acceptance of the intervention in a selected number of schools in Lebanon. Below is the data necessary to carry out a power calculation for the sample size required for a future large scale Cluster Randomised Controlled Trial.

Sample size calculation

The sample size has been calculated based on the following estimates:

$N=z^2 * p* (1-p)/m^2$

Whereby N = required sample size, z= confidence interval at 95%, p=estimated prevalence of dietary outcome, and m=margin of error (standard value of 0.05). Considering a prevalence of 50% in each group, with a 1:1 ratio for intervention and control groups (which yields the largest possible sample size), the minimum required overall sample size is 384 participants per group.

Given the cluster design, a variance inflation factor (VIF) or design effect (DEFF) will be considered using the following formula: 1+ (m-1)*ICC

Whereby: ICC= intra class correlation and m=average cluster size

As m or ICC increases, DEFF or VIF increases. For example, even if the ICC is only 0.026 (as published by *Murray et al., 2001*), if 100 students are observed in each school, then DEFF or VIF will be 3.57. This means that the variance of the intervention effect will be 3.57 times as large in a school-randomized trial compared to a situation where the students had been the units being randomized into the different intervention groups. Therefore, failure to account for that extra variation will result in small standard errors, large test statistics, and statistical inferences that are not valid.

For the pilot study, 8 schools were randomized, 4 into intervention and 4 into control. The number of students per cluster (or cluster size) ranged between 20 and 50 students. Assuming an average cluster size of 35 students, the table below calculates the needed sample size given a range of cluster sizes and ICC values.

Table 6.1: Sample size calculation given a range of clusters and ICC

Cluster size	ICC	VIF	VIF-adjusted sample size (VIF*384)	# of clusters needed
20	0.005	1.095	420	21
20	0.026	1.494	574	29
20	0.05	1.95	749	37
35	0.005	1.17	449	13
35	0.026	1.884	723	21
35	0.05	2.7	1037	30
50	0.005	1.245	478	10
50	0.026	2.274	873	17
50	0.05	3.45	1325	26

Thus the number of clusters (schools or classes, depending if one class has been randomised from within each school or not) could range anywhere from 10 to 37. However, it is recommended to increase the number of clusters as much as is feasible and affordable because they are the primary sampling unit and if the correlations between participants inside the cluster are high, extremely high, then the "effective" sample size of the cluster is much smaller than its actual size. Based on the findings, and given the absolute difference in change between the intervention and control groups, the present study was highly powered to detect the difference for some outcomes (example chips consumption, 100% power) but poorly powered for others (example fruit consumption, 10% power); this could explain the high Odds Ratios obtained for certain values without the statistically significant findings. As such, it is recommended that future studies estimate the sample size needed across many outcomes, especially if the difference between intervention and control groups is likely to be minimal.

6.8 Study Limitations

This study had several potential limitations that should be considered when planning for a full scale randomised controlled study.

Limitations in the study procedure:

- The sample size was not determined through power calculation. The study may have been underpowered for certain outcomes. This should be considered when planning for the full scale study as mentioned in the previous section.
- The researcher delivered the intervention herself with the help of one assistant researcher. For sustainability reasons, further investigations need to assess the effectiveness of such interventions when delivered by other trained personnel, such as the school teachers.
- The study duration was relatively short (three months), which is not sufficient to induce proper and sustained behaviour change and to detect changes in body composition. The study also lacks a follow-up assessment. Longer duration interventions must be considered when planning for later research studies.

Limitations in the study methods:

The results of this study were based on a self-administered questionnaire. Studies show that self-administered questionnaires tend to minimize social desirability bias compared with interviewer administration *(Tourangeau et al, 2000).* However, social desirability may arise from the relationship formed between the teacher and the students. Therefore, in order to prevent this type of bias, data collection should not be conducted by the teachers or the person performing the intervention. In the future roll-out of the programme, data collectors should not be involved with the study intervention. Blinding of outcome assessors is one of the key quality criteria highlighted in the CONSORT statement, and in the full trial we will adhere to this guidance where at all possible *(Moher et al, 2010).*

Although the use of very simplistic questionnaires to collect behaviour information can be subject to many limitations, the better options (to improve validity) were not practically possible in this study. The researcher could have used qualitative interviews and also observations of the children eating, but the resources were not available to do this. Below are the major limitations of the study methods:

- Dietary intake was measured only for meal patterns and types of snacks consumed and purchased. Future studies should incorporate in the data collection tool, questions on frequency of food intake, namely intake of fruits and vegetables.
- Questions assessing screen time habits might have been open to interpretation, although the researcher gave oral indications during data collection. This might have impacted the results pertaining to screen time. In the future, other labels must be considered, while taking into account the children’s cognitive abilities.
- Self-efficacy assessment questions do not necessarily highlight future planned behaviour or motivation. For future research, questions assessing children’s attitudes, availability and preference to healthy behaviours should be considered to complement self-efficacy questions.

Limitations in environmental mediators:

- The modification of the school food environment was not possible due to lobbying and lack of support of school authorities. Further efforts to modify the students' environment are warranted for future research.
- The parents included in the qualitative part of the study were a self-selected group and may not have been truly representative of the school parent communities in terms of nutrition knowledge and awareness. Parents who responded to the invitation to participate in the focus groups meetings might have been those who were the most interested in nutrition related health issues. However, the views of parents assessed in all schools were very similar despite the schools being quite diverse in socioeconomic status and religious affiliations.

6.9 Feasibility and sustainability of the Health-E-PALS intervention

6.9.1 Resources

The Health-E-PALS intervention was delivered by the study team (the researcher and a graduate assistant), and expenses related to material development were covered by a WHO Grant (see chapter 3 for details). Similar interventions were also primarily delivered by trained study personnel or by school-staff, usually teachers, after receiving training and material from the study team *(Waters et al, 2011).* In the present research study the novelty of somebody external helped ensure the acceptance and enthusiasm of the students, school personnel and parents. However, given the number of students and schools that should be reached, it would not be possible to rely solely on interventions that depend on input from health professionals, especially in situations of limited resources as is the case with Lebanese schools.

Since the delivery of the intervention by personnel not employed by the school is likely to be expensive and not sustainable, the best method for future roll out of the Health-E-PALS intervention should be through a “train the trainers” approach, in this case the teachers. As the educational material has been already developed and tested, there will be no extra cost on resources other than photocopying.

Further to the training of the trainer workshops, the Ministry of Higher Education in Lebanon should be consulted in order to examine as a future initiative the integration and implementation of Health-E-PALS sessions in the official school’s curriculum.

6.9.2 Following up and monitoring

During focus group discussions teachers expressed their willingness to get trained and be in charge of delivering the programme after integrating and coordinating the sessions in the core subjects of the classroom lessons. After receiving proper training and material the teachers/ health educators may possibly be capable to pursue the Health-E-PALS intervention in their respective schools. However, everyday duties and academic load might decrease teachers’ enthusiasm, and could be a barrier to sustained programme implementation.

Suitable teachers’ follow-up, hands-on training and monitoring should be accomplished on regular basis by an external body to ensure appropriate implementation of the programme and its sustainability. This can be achieved by a supervisor from the Ministry of Higher Education; A more efficient approach would be through partnership with didactic organisations such as local university programmes in nutrition and dietetics that can provide educators and students to help in training and monitoring as part of their educational curriculum and learning opportunities.

Sponsorships from local businesses can provide fresh, local produce for food tasting and recipe preparation thus minimizing cost of food purchase and further ensuring programme sustainability.

Initiatives such as the Healthy Schools Recognition Program developed in Ontario, Canada *(www.edu.gov.on.ca/healthyschools),* and HealthierUS School Challenge in the United States *(www.teamnutrition.usda.gov)* give an additional incentive to schools to adopt healthier school environments. Awards and recognition provided to schools for adoption of Health-E-PALS intervention components can further help in programme sustainability.

Chapter seven: Conclusion and recommendations

7.1 Conclusion

The Health-E-PALS study was developed to encourage healthy eating and physical activity in Lebanese school children aged 9-11 years. The programme was tailored according to Lebanese and Arab culture and used the Social Cognitive Theory constructs for the development of the intervention. The multi-component intervention included a classroom curriculum, parental involvement and a food service component. The study used a mixed-method approach to assess effectiveness of the intervention on students' eating and physical activity habits as well as on nutritional knowledge and self-efficacy for change.

The study showed that culturally appropriate, theory based classroom curriculum that includes interactive learning, significantly increased students' nutritional knowledge and self-efficacy post-intervention. The programme was as well successful in decreasing students' purchase and consumption of high energy dense snacks and beverages. It also helped in increasing students' daily breakfast intake. Furthermore, the study decreased students' habit of eating in front of the television.

The intervention did not have a positive effect on physical activity and sedentary behaviours except for unorganised play during school recess. This suggests that longer interventions and efforts to increase physical activity during school hours would be needed.

Results from the focus group discussions showed that the intervention was generally well accepted by students, teachers and their parents. The intervention was viewed as novel due to its cultural sensitive and innovative components. The students learned to change their eating habits in a pleasurable way, and were successful in trying new healthy foods and preparing recipes. The programme was well integrated within the school curriculum and was well accepted by teachers and school principals. Parents acknowledged the fact that their children were encouraged to increase their consumption of healthy foods and drinks and that the programme positively affected the family food environment. All groups agreed that longer duration interventions and sustainability of the programme will be required.

The study also established that the influence and commercial nature of the school shops prevented the improvement of the school food environment. The Health-E-PALS efforts to persuade school officials to improve food selections in school shops were not sufficient. The intervention should be complemented by policies that enforce the type of foods that should be available to students in school shops.

The intervention had no effect on BMI or waist circumference and the significant changes observed on some behavioural changes were all on self-report measures.

The use of both quantitative and qualitative research methods in the present study broadened the researcher’s understanding of students’ and parents’ perceptions and dietary practices. The use of qualitative research methods were key in gaining better discernment of some important factors that influenced students’ behaviour in the present study; namely food selection in school shops, lack of sports and leisure facilities, children’s food preferences and their attractiveness to electronic games.

The Social Cognitive Theory constructs used to develop the framework of the Health-E-PALS intervention proved beneficial in targeting behaviours of 9-11 year old children. This further demonstrated that theoretically based, behaviour oriented interventions seem to be effective in eliciting dietary change in school aged children.

7.2 Recommendations

Further to the piloting of the Health-E-PALS study and the findings pertaining to its feasibility, the next steps would entail to plan for a large scale evaluation of a randomised controlled trial to test the effectiveness of the present intervention on a greater number of schools from different regions of Lebanon with the school personnel as the study deliverer. The large scale trial will also assess the impact of the intervention at follow up (of one year). The dissemination and sustainability of the project would then be monitored to address long-term effects of such interventions on childhood obesity prevention in Lebanon and the region.

Furthermore, given the particular social and cultural context of the present study, its applicability and transferability to other countries of the region ought to be considered. Factors that influence transferability of interventions from the study setting to another include: the baseline prevalence of the health problem in the other setting, the characteristics of the target population, social acceptability, and available resources and skills of the local providers *(Wang et al, 2005).*

As discussed previously, the increased prevalence of childhood obesity is a common problem in most countries of the Middle East region; interventions to curb this crisis are required. Arab children, aged 9-11 years share similar ethnicity and culture, food consumption patterns, and level of literacy. The content of the present intervention were tailored to suit the Arab culture, with materials developed in Arabic and featuring local foods and recipes. Minimal adjustments would be needed to adapt the contents of the programme to other countries of the region. Hence, studies testing the effectiveness of this intervention in other Arab nations are recommended, using local available resources.

In addition, the following key recommendations are suggested to policy makers when planning beneficial obesity prevention programmes targeted to Lebanese and Arab school children that can be sustained overtime:

- Integrate Health-E-PALS educational components into regular school curriculum through fun and interactive activities spread across the whole academic year.
- Increase the physical education sessions to more than three mandatory per week and support after school physical activities.
- Engage with local university nutrition education programmes to provide training and support to teachers and staff in implementing and promoting healthy behaviours and activities. Hiring a full time nutritionist can be envisaged by schools who can afford it.
- Improve the nutritional quality of foods available to students in school shops and canteens by enforcing laws preventing the sale of high energy dense foods and snacks and the provision of healthy alternatives that would appeal to children.
- Involve parents in the programme to complement and encourage healthy behaviours in the home environment. Parents can help by making healthy foods available and accessible at home, and by encouraging physical activity and limiting access to sedentary ones.
- Extend the intervention to younger children and their parents to build good eating habits early on and maximise the likelihood of sustaining those habits for life. It has been established that as of preschool age, children develop specific tastes for certain foods and these habits are maintained through adolescence and adulthood.

Reducing childhood obesity and preventing unhealthy weight gain should be dealt with by several parts of the society. The education sector would need to collaborate closely with all sectors of the society to address the childhood obesity problem.

Efforts are to be raised at the governmental levels, especially the ministries of health and education *(WHO, 2007).* Ideally, childhood obesity should be tackled at a multisectoral stage and involve along with the local government, NGOs, the media and the private sector (*Summerbell, et al, 2012)*.

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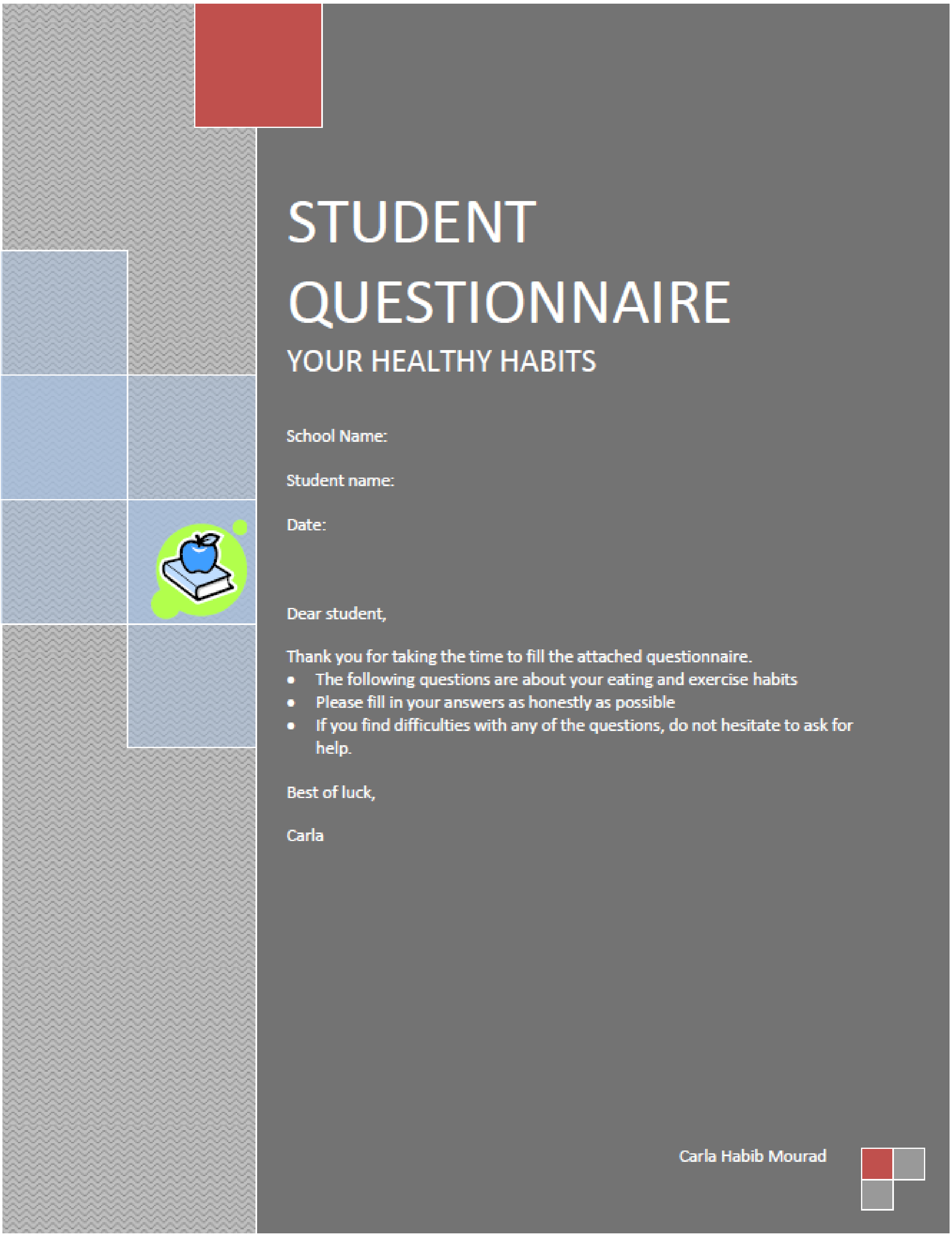
Appendix A: Final Questionnaire



STUDENT QUESTIONNAIRE

YOUR HEALTHY HABITS

School Name:

Student name:

Date:

Dear student,

Thank you for taking the time to fill the attached questionnaire.

- The following questions are about your eating and exercise habits
- Please fill in your answers as honestly as possible
- If you find difficulties with any of the questions, do not hesitate to ask for help.

Best of luck,

Carla

Carla Habib Mourad

Circle the answer that mostly fits with your daily habits.

1- **Do you usually have breakfast?**
   1) Never
   2) Sometimes
   3) Yes, every day

2- **Do you usually have lunch?**
   1) Never
   2) Sometimes
   3) Yes, every day

3- **Do you usually have dinner?**
   1) Never
   2) Sometimes
   3) Yes, every day

4- **Do you usually have snacks between your meals?**
   1) Yes
   2) No

5- **if yes, do you take any of these snacks between your meals (at school or at home)?**
   1) fruits
   2) chocolate or cookies
   3) soft drinks
   4) juice
   5) chips
   6) cheese sandwich

6- **How many snacks do you have a day?**
   1) One
   2) Two
   3) Three or more

7- **Do you buy food from your school shop?**
   1) yes
   2) no

8- **What do you buy from your school shop?**
   1) Chocolate or cookies
   2) Juice
   3) Soft drinks
   4) Water
   5) Croissant
   6) Manoushe
   7) Chips or peanuts

9- **Do you bring food with you to school from home?**
   1) Yes
   2) No

10- **Do you choose what to put in your lunch box?**
   1) Yes
   2) No
   3) Sometimes

11- How many times a week you eat outside home or have a delivery meal?

1) 3 or more times per week
2) Twice per week
3) Once per week
4) Never

12- Do you choose some of the foods your parents buy from the supermarket?

1) Yes
2) No

13- Do you watch TV during school days?

1) I watch TV a lot everyday
2) I watch TV a little before I go to sleep
3) I don't watch TV

14- Do you watch TV during week- ends?

1) All day
2) Twice a day
3) Once a day
4) I don't watch TV

15- Do you eat while watching TV?

1) All the time
2) Sometimes
3) No

16- **What do you play at school during recess?**
1) I don't play
2) I play ball games
3) Jumping rope
4) I run or play "catch me if you can"
5) Other

17- **Do you play at home after school?**
1) Yes
2) No
3) Sometimes

18- **If yes, what do you play at home after school?**
1) I don't play
2) I play ball games
3) I ride my bike or my rollers/skates

19- **How many days a week do you have sports/exercise sessions at school?**
1) Not one day
2) One day
3) Two days
4) More than three

20- **Do you participate in the exercise sessions at school?**
1) I don't participate at all
2) Sometimes
3) Yes, every time

21- How many times per week do you do sports (Football, Basket Ball, Dance, Judo, Swimming...) after school or during the week-end?

1) I don't
2) Once per week
3) 2 times per week
4) 3 times or more

22- Do you play computer games; Play station, PSP, Nintendo after school?

1) Every day for a long time
2) Every day for a short time
3) 2-3 times a week
4) I don't play

23- Do you play computer games; Play station, PSP, Nintendo during week-ends? (You can choose more than one answer)

1) All day
2) Twice a day
3) Once a day
4) I don't play

24- From which type of food you should eat the *least*?(choose only one type of food)

1) Bread, rice and pasta
2) Milk, cheese and yogurt
3) Sweets, fats and oils
4) Fruits and vegetables
5) Meat, chicken and eggs
6) I don't know

25- From which type of food you should eat the *most*?(choose only one)

1) Bread, rice and pasta
2) Milk, cheese and yogurt
3) Sweets, fats and oils
4) Fruits and vegetables
5) Meat, chicken and eggs
6) I don't know

26- How many servings of fruits and vegetables you should have a day?

1) One
2) 2 or 3
3) 4 or 5
4) 5 or more
5) I don't know

27- Eating breakfast helps me do well in class.

1) Yes always
2) Sometimes
3) No, never

28- The best fluid for my body is: *(choose one answer)*

1) Water
2) Juice
3) Soft drinks
4) I don't know

29- Juice and soft drinks cause dental caries.

1) Yes
2) No
3) I don't know

30- **Chocolate and candies cause dental caries.**

1) Yes
2) No
3) I don't know

31- **Which of these foods have less fat?**

1) fried potatoes
2) baked potatoes
3) I don't know

32 - Which of these foods have less fat?

1) croissant
2) corn flakes
3) I don't know

33- Which of these foods have less fat?

1) chips
2) pop corn
3) I don't know

34-Which of these foods have less sugar?

1) soft drinks
2) Milk
3) I don't know

35 - Which of these foods have less sugar?

1) doughnuts
2) corn flakes
3) I don't know

36 - Which of these foods have less sugar?

1) fresh juice
2) tang (artificial juice)
3) I don't know

37-For my health, I should exercise :

1) every day
2) once a week
3) twice a week
4) I don't know

38- How sure are you that you can prepare a healthy breakfast by yourself?

1) Very sure
2) Little sure
3) Not sure

39 - How sure are you that you can prepare a healthy snack by yourself?

1) Very sure
2) Little sure
3) Not sure

40 -How sure are you that you can drink less sweet and soft drinks?

1) Very sure
2) Little sure
3) Not sure

41 -How sure are you that you can do more sports during the week?

1) Very sure
2) Little sure
3) Not sure

42 -How sure are you that you can eat more fruits a day?

1) Very sure
2) Little sure
3) Not sure

43 -How sure are you that you can eat more vegetables a day?

1) Very sure
2) Little sure
3) Not sure

44 -How sure are you that you can eat breakfast every day?

1) Very sure
2) Little sure
3) Not sure

45 -How sure are you that you can eat a fruit instead of another snack during the day?

1) Very sure
2) Little sure
3) Not sure

46-How sure are you that you can spend less time playing computer and PlayStation games?

1) Very sure
2) Little sure
3) Not sure

47 -The food I eat can affect my health.

1) Yes
2) No
3) I don't know

48 -The foods that I eat now are healthy.

1) Yes
2) No
3) I don't know

49 -People who weigh more than they should, may have health problems

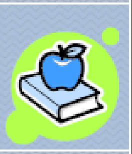
1) Yes
2) No
3) I don't know

Thank you 

Appendix B: Questionnaire before piloting

STUDENT QUESTIONNAIRE

YOUR HEALTHY HABITS



School Name:

Student name:

Date:

Dear student,

Thank you for taking the time to fill the attached questionnaire.

- The following questions are about your eating and exercise habits
- Please fill in your answers as honestly as possible
- If you find difficulties with any of the questions, do not hesitate to ask for help.

Best of luck,

Carla

Carla Habib Mourad

<u>Circle the answer that mostly fits with your daily habits</u>

1. Do you usually eat breakfast?
    1) Never
    2) Sometimes: times per week -------------------
    3) Regularly every day

2. Do you usually eat lunch?
    1) Never
    2) Sometimes: times per weeks --------------------
    3) Regularly every day

3. Do you usually eat dinner?
    1) Never
    2) Sometimes: times per weeks -----------------------
    3) Regularly every day

4. Do you usually eat small snacks (chips, chocolate, fruits…) between main meals?
    1) Never
    2) Sometimes: times per weeks ------------------------
    3) Regularly every day

5. If the answer is “Yes”, how many snacks do you eat daily?
    1) 1
    2) 2
    3) 3
    4) 4
    5) More than 4 times, specify --------------------

6. Do you buy food from your school shop?
    1) Yes
    2) No

    6.1 If yes, what do you buy from your school shop?
    1) Chocolate
    2) Soft drinks
    3) Juice
    4) Chips

7. Do you bring food with you to school from home?
    1) Yes
    2) No

    7.1 If yes, specify what: ---------------------------------

8. Do you choose some of the foods your parents buy from the supermarket?
   1) Yes
   2) No

   8.1 If yes, what type of food: ---------------------------------

9. Do you usually eat while watching Television?
   1) Never
   2) Sometimes, days per week______
   3) Most of the times

10. In average, how many times per week you eat outside your house?
    1) Never
    2) 1
    3) 2
    4) 3
    5) More than 3 times, specify ----------------------

11. How many days of the week, do you have a sport session at school?
    1) Never
    2) 1 day
    3) 2 days
    4) 3 days or more

12. Do you participate in all the sport sessions at school?
    1) Yes
    2) Some of them
    3) No

13. What do you mostly play during recess?
    1) I don't play
    2) I play ball games
    3) Jumping rope
    4) I run or play "catch me if you can"
    5) I walk

14. What do you play at home after school?
    1) I don't play
    2) I play ball games
    3) I ride my bike my rollers / skates
    4) I run or play "catch me if you can"
    5) I walk

15. How many times per week do you do sports (Football, Basketball, Dance, judo, swimming) after school or during the weekend?
    1) 1 time per week
    2) 2 times per week
    3) 3 times per week
    4) 4 or more
    5) I don’t

16. How much time do you play computer games; Play station, PSP Nintendo during school days?
    1) 30 minutes - 1 hour
    2) 1hour - 2 hours
    3) More than 2 hours
    4) I don’t play

17. How much time do you play computer games; Play station, PSP Nintendo during week-ends?
    1) 30 minutes - 1 hour
    2) 1hour - 2 hours
    3) More than 2 hours
    4) I don’t play

18. How much time do you watch TV during school days?
    1) 30 minutes - 1 hour
    2) 1hour - 2 hours
    3) More than 2 hours
    4) I don’t play

19. How much time do you watch TV during weekends?
    1) 30 minutes - 1 hour
    2) 1hour - 2 hours
    3) More than 2 hours
    4) I don’t play

20. Eating breakfast is:

    1) Very important
    2) Important
    3) Not important
    4) Not at all important
    5) I don’t know

21. In one day, how many servings of fruits and vegetables you have? (Choose one answer)
    1) One
    2) 2 or 3
    3) 4
    4) 5 or more
    5) I don't know

22. The best fluid for my body is: (Choose one answer)
    1) Water
    2) Juice
    3) Soft drinks
    4) I don't know

23. Do juice and soft drinks cause dental caries?
    1) Yes
    2) No
    3) I don't know

24. Do chocolate and candies cause dental caries?
    1) Yes
    2) No
    3) I don't know

25. Which of these two foods has less fat?
    1) A. Fried potatoes or B. Baked potatoes
    2) A. Croissant or B. Corn Flakes
    3) A. Popcorn or B. Chips
    4) I don't know

26. Which of these two drinks has less sugar?
    1) A. Soft drink or B. Milk
    2) A. Fresh juice or B. Sweet drinks
    3) A. Biscuits or B. Fruits
    4) I don't know

27. For my better health, I should exercise:
    1) Every day
    2) Once a week
    3) Twice a week
    4) I don't know

28. How sure are you that you can prepare a healthy breakfast yourself?
    1) Very sure
    2) Little sure
    3) Not sure

29. How sure are you that you can prepare a healthy snack by yourself?
    1) Very sure
    2) Little sure
    3) Not sure

30. How sure are you that you can drink fresh juice instead of soft drinks?
    1) Very sure
    2) Little sure
    3) Not sure

31. How sure are you that you can exercise every day?
    1) Very sure
    2) Little sure
    3) Not sure

32. In one day, how sure are you that you can eat 4 servings of fruits?
    1) Very sure
    2) Little sure
    3) Not sure

33. In one day, how sure are you that you can eat 4 servings of vegetables?
    1) Very sure
    2) Little sure
    3) Not sure

34. How sure are you that you can eat breakfast every day?
    1) Very sure
    2) Little sure
    3) Not sure

35. How sure are you that you can eat fruits instead of chips & chocolate?
    1) Very sure
    2) Little sure
    3) Not sure

36. How sure are you that you can exercise instead of playing computer and PlayStation games?
    1) Very sure
    2) Little sure
    3) Not sure

37. The food I eat can affect my health
    1) Yes
    2) No
    3) I don’t know

38. The food that I eat now are healthy
    1) Yes
    2) No
    3) I don’t know

39. People who weigh more than they should may have health problems?
    1) Yes
    2) No
    3) I don’t know

Appendix C: <u>Ethical Approval and Consent Forms</u>

لجنة الأخلاقيات
كلية الطب
INSTITUTIONAL REVIEW BOARD
FACULTY OF MEDICINE

American University of Beirut
الجامعة الأميركية في بيروت

To: Dr. Nahla Hwalla
Date: March 12, 2008

Principal Investigator: Dr. Nahla Hwalla
American University of Beirut
Protocol Number: NUT.NH.12
Protocol Name: Interventions to promote healthy eating and physical activity in Lebanese School Children

Thank you for submitting to the IRB the above named study for review.

The IRB reviewed the study, the English and Arabic informed consent forms (for parents, version date March 2008), the English and Arabic Assent forms (for children, version date March 2008), the English and Arabic questionnaire and the English and Arabic Food Record Data sheets in an expedited manner.

This is to grant you approval to the study, the English and Arabic informed consent forms (for parents, version date March 2008), the English and Arabic Assent forms (for children, version date March 2008), the English and Arabic questionnaire and the English and Arabic Food Record Data sheets for a period of one year from the above date, at which time a progress report is kindly requested from you.

The membership of this Institutional Review Board complies with the membership requirements defined in the US Code of Federal Regulation (21CFR56 and 45CFR46) of the Food and Drug Administration. In addition, the IRB operates in a manner consistent with Good Clinical Practices under the ICH guidelines, with FDA and applicable national/local regulations.

Sincerely,

Ibrahim Salti, MD, PhD
Chairperson of the IRB

Cc. Dr. Ali Bazarbachi, Assistant Dean for Research, Faculty of Medicine

BLISS STREET - P.O.BOX 11-0236 - BEIRUT - LEBANON - TEL (961) 1 350 000 - EXT. 4910/1 - FAX (961) 1 744 464 - E-mail: reskan@aub.edu.lb
NEW YORK OFFICE: 3 DAG HAMMARSKJOLD PLAZA, 8TH FLOOR - NEW YORK, NY 10017-2303 U.S.A. - TEL. (212) 583 7677 - FAX (212) 583 7650

Faculty of Medicine
Office of
Assistant Dean for Research
07 MAR 2008
RECEIVED

Minor's Initials ____
Institutional Review Board
American University of Beirut
Faculty of Medicine
Bliss Street
Beirut, Lebanon
Tel: (01) 350-000 ext. 4910/4911

CHILD PARTICIPANT ASSENT FORM

(approximate ages 7-12)

Project Title: Interventions to promote healthy eating and physical activity in Lebanese Schoolchildren
Protocol Number:
Principal Investigator(s): Dr. Nahla Hwalla

Co-investigators: Dr.Rima Afifi
Dr.Lara Nasreddine
Carla Habib Mourad

Address: American University of Beirut
Bliss Street
Beirut,Lebanon

Phone: 01-350000 Ext 4400

Site where the study will be conducted: Schools of participants

This is a study about 200 children of your age to see a nutritional educational kit will be useful to teach nutrition to children your age. First, your parents will be asked if they give their permission for you to be in this study. If your parents don't agree, you cannot be in the study.
If your parents do agree, and you agree too, this is what will happen:

a. You will answer some questions about what you usually eat
b. You will participate in class sessions and activities that will teach new things about nutrition.
c. We will measure your weight, height and waist circumference.

Can anything bad happen to me?

Answering our questions and measuring your height and weight will not cause you any pain or harm.

Institutional Review Board
Version # 1, Date March 2008
Protocol # NUT.NH.12
Page 1 of 2

Institutional Review Board
Faculty of Medicine
American University of Beirut
12 MAR 2008
APPROVED

Minor's Initials ____

Can anything good happen to me?

You will learn how to make better food choices that will help you stay in good health.

Do I have other choices?

You can choose not to be in this study

Will anyone know I am in the study?

We won't tell anyone you took part in this study. When we are done with the study, we will write a report about what we found out. We won't use your name in the report.

Before you say yes to be in this study: be sure to ask Dr. ______ to tell you more about anything that you don't understand.

What if I do not want to do this?

You don't have to be in this study. It's up to you. If you say yes now, but you change your mind later, that's okay too. All you have to do is tell us.

If you want to be in this study, please sign or print your name.

☐ Yes, I will be in this research study. ☐ No, I don't want to do this.

Child's name	signature of the child	Date
Person obtaining Assent	signature	Date

Institutional Review Board
Version # 1, Date March 2008
Protocol # NUT.NH.12
Page 2 of 2

Institutional Review Board
Faculty of Medicine
American University of Beirut
1 2 MAR 2008
APPROVED

Parent's Consent for minors to participate in a research study

Interventions to promote healthy eating and physical activity in Lebanese schoolchildren

Investigator: Dr. Nahla Hwalla

Co-Investigators: Dr.Rima Afifi
Dr.Lara Nasseredine
Mrs. Carla Habib Mourad

Address: American University of Beirut
Bliss Street
Beirut, Lebanon

Phone: (01) 350000 Ext: 4400

Faculty of Medicine
Office of
Assistant Dean for Research
07 MAR 2008
RECEIVED

Site where the study will be conducted: Homes of participants

You are being asked to let your child participate in study entitled: "In terventions to promote healthy eating and physical activity in Lebanese schoolchildren", conducted by the American University of Beirut. Please take time to read the following information carefully before you decide whether you want to take part in this study or not. Feel free to ask your doctor if you need more information or clarification about what is stated in this form and the study as a whole.

Purpose of the research

Chronic diseases including obesity are a major public health challenge worldwide. The purpose of this study is to test the effectiveness of a school based educational kit to increase nutrition awareness and physical activity in schoolchildren, in order to prevent and decrease childhood obesity.

Why is your child being asked to take part in this study?

In order to fulfill the objective of this study, we will need to include a sample of Lebanese schools. Your child school was chosen randomly.

What is involved in the study?

- Your child will answer a questionnaire where questions will cover eating habits and lifestyle information.

- Your child's weight, height, waist circumference will be measured. He will also participate in weekly lessons and activities about nutrition and physical activity.

What risks and discomfort might your child experience if you agree that your child participate in the study?

The study does not have any risks on your child's health.

Institutional Review Board
Faculty of Medicine
American University of Beirut
12 MAR 2008
APPROVED

What are the potential benefits of participating in this study?

NUT.NH.12 March 2008 Page 1 of 2

Your child will learn how to improve his eating habits and increase his physical activity. He will participate in activities that will encourage him to taste and prepare healthy recipes.

Confidentiality

The investigators are committed to preserve the anonymity of the participant, to keep the results confidential and to give them only to the participant involved.
If you agree that your child participates in this research study, the information will be kept confidential. Unless required by law, only the study doctor and designee, the ethics committee and inspectors from governmental agencies will have direct access to your medical records.

Investigator's Statement:

I have reviewed, in detail, the informed consent document for this research study with ______________________________ (name of patient, legal representative, or parent/guardian) the purpose of the study and its risks and benefits. I have answered to all the patient's questions clearly. I will inform the participant in case of any changes to the research study.

______________________________ ____________________
Name of Investigator or designee **Signature**

____
Date

Patient's Participation:

I have read and understood all aspects of the research study and all my questions have been answered. I voluntarily agree to be a part of this research study and I know that I can contact Dr. Nahla Hwalla at 01-350000 Ext 4400 or any of his/her designee involved in the study in case of any questions. If I feel that my questions have not been answered, I can contact the Institutional Review Board for human rights, Dr. Ibrahim Salti at 01-350000 Ext 4911.
I understand that my son/daughter are free to withdraw his consent and discontinue participation in this project at any time, even after signing this form, and it will not affect him/her in any way. I know that I will receive a copy of this signed informed consent.

______________________________ ______________________________
Name of Patient or Legal Representative or Parent/Guardian **Signature**

____
Date

______________________________ ______________________________
Witness's Name (if parent does not read) **Witness's Signature**

____
Date

Institutional Review Board
Faculty of Medicine
American University of Beirut
12 MAR 2008
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لجنة الأخلاقيات
INSTITUTIONAL REVIEW BOARD

AUB American University of Beirut
الجامعة الأميركية في بيروت

To: Dr. Nahla Hwalla
Date: May 04, 2010

Principal Investigator:	Dr. Nahla Hwalla American University of Beirut
Protocol Number:	NUT.NH.12
Protocol Name:	Interventions to promote healthy eating and physical activity in Lebanese school children

Thank you for submitting to the IRB your letter received on April 22, 2010 in response to the IRB letter dated April 08, 2010 for review.

The IRB reviewed in an expedited manner the letter, the amended English and Arabic versions of the Adult's Consent form (version received April 22, 2010), the amended English and Arabic versions of the child assent form (version received April 22, 2010), and the amended English and Arabic versions of the parent's consent for minors to participate in a research study (version received April 22, 2010).

This is to grant you approval for conducting the focus interviews, the English and Arabic versions of the flyers for the teachers, the English and Arabic versions of the flyers for the parents, the amended English and Arabic versions of the Adult's Consent form (version received April 22, 2010), the amended English and Arabic versions of the child assent form (version received April 22, 2010), and the amended English and Arabic versions of the parent's consent for minors to participate in a research study (version received April 22, 2010) for a period ending March 12,2011; at which time a progress report is kindly requested from you.

The American University of Beirut and its Institutional Review Board, under the Institution's Federal Wide Assurance with OHRP, comply with the Department of Health and Human Services (DHHS) Code of Federal Regulations for the Protection of Human Subjects ("The Common Rule") 45CFR46, subparts A, B, C, and D, with 21CFR56; and operate in a manner consistent with the Belmont report, FDA guidance, Good Clinical Practices under the ICH guidelines, and applicable national/local regulations.

Sincerely, Michael Clinton

Michael Clinton, PhD
IRB Vice Chairperson
Social & Behavioral Research

Cc: Ibrahim Salti, MD, PhD
Chairperson of the IRB

Ghada El Hajj Fuleihan, MD, MPH
Associate Dean for Clinical Research, Faculty of Medicine

LEO

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كلية العلوم الزراعية والغذائية
FACULTY OF AGRICULTURAL AND FOOD SCIENCES

AUB American University of Beirut
الجامعة الأميركية في بيروت

Dear teachers,

The Nutrition and Food Sciences department at the American University of Beirut, who previously implemented the project entitled "Interventions to promote Healthy Eating and Physical Activity in Lebanese School children" at your school, would like to conduct a small group interview with the teachers whose students participated in the project.

The interview will cover questions about the different sessions of "kanz –al- Soha", the nutrition lessons presented to your students, during the previous months.

If interested to be part of this group discussion, please leave your name with the school director, and we will contact you for the date of the meeting.

Thank you for your cooperation.

Institutional Review Board
Faculty of Medicine
American University of Beirut
0 4 MAY 2010
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BLISS STREET - P.O.BOX 11-0236 - BEIRUT - LEBANON - TEL (961 1 343002) FAX (961 1 744460) - E-mail: fafs@aub.edu.lb
NEW YORK OFFICE: 3 DAG HAMMARSKJOLD PLAZA, 8TH FLOOR, NEW YORK, NY 10017-2303 U.S.A. - TEL (1 212 583 7677) FAX (1 212 583 7650)

كلية العلوم الزراعية والغذائية
FACULTY OF AGRICULTURAL AND FOOD SCIENCES

AUB American University of Beirut
الجامعة الأميركية في بيروت

Dear Parents,

The Nutrition and Food Sciences department at the American University of Beirut, who previously implemented the project entitled "Interventions to promote Healthy Eating and Physical Activity in Lebanese School children" at your child's school, would like to conduct a small group interview with both you and your children.

The interview will cover questions about the different sessions of "kanz –al- Soha", the nutrition lessons presented to your children, during the previous months.

If interested to be part of this group discussion, please leave your name with the school director, and we will contact you for the date of the meeting.

Thank you for your cooperation.

Institutional Review Board
Faculty of Medicine
American University of Beirut

0 4 MAY 2010

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NEW YORK OFFICE: 3 DAG HAMMARSKJOLD PLAZA, 8TH FLOOR, NEW YORK, NY 10017-2303 U.S.A. - TEL (1 212 583 7677) FAX (1 212 583 7650)

Adult's Consent form

Interventions to promote healthy eating and physical activity in Lebanese schoolchildren

Institutional Review Board
American University of Beirut
22 APR 2010
RECEIVED

Investigator: Dr. Nahla Hwalla

Protocol Number: NUT.NH.12

Co-Investigators: Dr.Lara Nasereddine
Dr.Rima Afifi
Mrs. Carla Habib Mourad

Address: American University of Beirut
Bliss Street
Beirut, Lebanon

Phone: (01) 350000 Ext: 4400

Site where the study will be conducted: Schools of participants

Now that kanz al Saha research study has ended, we would like to have your opinion concerning some aspects of the project.

What is involved in the study?

We will have a meeting with you for 30 minutes and we will ask you some questions concerning the sessions your students attended and how did this affect his or her eating habits.

We will be using a tape recorder, if this bothers you please let us know, and we will turn it off at any time during the meeting. You are free to leave the meeting any time you like.

Confidentiality

The investigators are committed to preserve the anonymity of the participant, to keep the results confidential and to give them only to the participant involved.

If you agree to participate in this research study, the information will be kept confidential. Unless required by law, only the study doctor and designee, the ethics committee and inspectors from governmental agencies will have direct access to your medical records.

Institutional Review Board
Faculty of Medicine
American University of Beirut
? 4 MAY 2010
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Page 1 of 2

Participant's statement

I have read and understood all aspects of the research study and all my questions have been answered. I voluntarily agree to be a part of this research study and I know that I can contact Dr. Nahla Hwalla at 01-350000 Ext 4400 or any of his/her designee involved in the study in case of any questions. If I feel that my questions have not been answered, I can contact the Institutional Review Board for human rights at 01-350000 Ext 4911.

I understand that I am free to withdraw this consent and discontinue participation in this project at any time, even after signing this form. I know that I will receive a copy of this signed informed consent.

Name of Participant

Signature

Date

Name of Investigator or designee

Signature

Date

Institutional Review Board
Faculty of Medicine
American University of Beirut
2 4 MAY 2010
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Page 2 of 2

Parent's Consent for minors to participate in a research study

Interventions to promote healthy eating and physical activity in Lebanese schoolchildren

Investigator: Dr. Nahla Hwalla

Protocol Number: NUT.NH.12

Co-Investigators: Dr.Lara Nasseredine
Mrs. Carla Habib Mourad

Address: American University of Beirut
Bliss Street
Beirut, Lebanon

Phone: (01) 350000 Ext: 4400

Institutional Review Board
American University of Beirut
2 2 APR 2010
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Site where the study will be conducted: Schools of participants

Now that your child has completed all the sessions of Kanz al Saha project, we would like to have your opinion as well as his, concerning some aspects of the project.

What is involved in the study?

We will have a meeting with you and your child separately for 30 minutes and we will ask you some questions concerning the sessions your child attended and how did this affect his or her eating habits.
We will be using a tape recorder, if this bothers you please let us know, and we will turn it off at any time during the meeting. You are free to leave the meeting any time you like.

Taking part in this meeting will not affect in any way your child's school records or activities.

Confidentiality

The investigators are committed to preserve the anonymity of the participant, to keep the results confidential and to give them only to the participant involved.
If you agree that you and your child participate in this research study, the information will be kept confidential. Unless required by law, only the study doctor and designee, the ethics committee and inspectors from governmental agencies will have direct access to the information you provided us.

Institutional Review Board
Faculty of Medicine
American University of Beirut
0 4 MAY 2010
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Page 1 of 2

Patient's Participation:

I have read and understood all aspects of the research study and all my questions have been answered. I voluntarily agree to be a part of this research study and I know that I can contact Dr. Nahla Hwalla at 01-350000 Ext 4400 or any of his/her designee involved in the study in case of any questions. If I feel that my questions have not been answered, I can contact the Institutional Review Board for human rights at 01-350000 Ext 4911.

I understand that I am free to withdraw this consent and discontinue participation in this project at any time, even after signing this form. I know that I will receive a copy of this signed informed consent.

If you agree to participate both you and your child to the meeting, please sign below.

Name of the child

Name of Parent ____________________

Signature ____________________

Date ____________________

If you agree to participate in the meeting but do not want your child to participate, please sign below.

Name of Parent --

Signature ---------------------------

Date ____________________

Name of Investigator or designee --------------------------------

Signature--------------------------

Date ____________________

Institutional Review Board
Faculty of Medicine
American University of Beirut
MAY 2010
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Page **2** of **2**

Institutional Review Board
American University of Beirut
22 APR 2010
RECEIVED

Minor's Initials ____

Institutional Review Board
American University of Beirut
Faculty of Medicine
Bliss Street
Beirut, Lebanon
Tel: (01) 350-000 ext. 4910/4911

CHILD PARTICIPANT ASSENT FORM

(approximate ages 7-12)

Project Title: Interventions to promote healthy eating and physical activity in Lebanese Schoolchildren

Protocol Number: NUT.NH.12

Principal Investigator(s): Dr. Nahla Hwalla

Co-investigators:

Dr.Lara Nassereddine
Carla Habib Mourad

Address:

American University of Beirut
Bliss street
Beirut,Lebanon

Phone: 01-350000 Ext 4400

Site where the study will be conducted: Schools of participants

Now that the Kanz al Saha project is finished, we would like to get your opinion about the sessions and what you thought about them.

First, your parents will be asked if they give their permission for you to be in this study. If your parents don't agree, you cannot be in the study.
If your parents do agree, and you agree too, we will meet for 30 minutes and will ask you some questions about the lessons you participated in and how it affected your eating habits. We are going to use a tape recorder to be able to remember everything you say. If at any time you want to leave the group and go back to class, you are free to do so.

Do I have other choices?

You can choose not to be in this study

Institutional Review Board
Faculty of Medicine
American University of Beirut
04 MAY 2010
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1

Minor's Initials ____

Will anyone know I am in the study?

We won't tell anyone you took part in this study. When we are done with the study, we will write a report about what we found out. We won't use your name in the report.

Before you say yes to be in this study; be sure to ask Mrs. Carla Habib to tell you more about anything that you don't understand.

What if I do not want to do this?

You don't have to be in this study. It's up to you. If you say yes now, but you change your mind later, that's okay too. All you have to do is tell us.

If you want to be in this study, please sign or print your name.

☐ Yes, I will be in this research study. ☐ No, I don't want to do this.

Child's name	signature of the child	Date
Person obtaining Assent	signature	Date

Institutional Review Board
Faculty of Medicine
American University of Beirut
14 MAY 2010
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2

Appendix D: Lesson Plans

Lesson Plan: Introduction to food groups

Objectives:

At the end of the session, children will be able

- To classify foods into their appropriate groups.
- To classify one food intake into food groups

Points to discuss in class:

We need to eat different kinds of foods in varying amounts to keep our bodies functioning well.

- There are six different food groups + the extras
- Each group provides certain nutrients that help our bodies work at their best. We need about 40 nutrients which fall into six classes of nutrients: carbohydrates, proteins, fats, vitamins and minerals, water.
- Foods contain other substances we call plant chemicals, those are beneficial substances that protect our body from harmful substances.

Activity: Food Cards

Materials needed:

- Poster: Food groups
- Food cards
- Tack-it

Activity plan:

- Distribute food cards among children (each student will get 3 to 4 cards)
- Let the teacher pass by the students to stick the “Tack-it” on the back of each card
- Ask each student to come up, read out loud the food card, and stick it on the appropriate food group on the poster

Lesson Plan: Food benefits

Objectives:

At the end of the session, children will:

- Know the importance of eating different kinds of foods
- Know how much to eat from each food group

Points to discuss in class

Role of each food group:

- GRAINS: most of our servings must come from the grains group because they are rich in energy from the carbohydrates that are the fuel of the body (we need them to play, do sports, breath, for our heart to beat, to stay alive..). They also contain fiber (in whole grains), those are substances that help our body to move foods through the digestive system, and decrease sugar and cholesterol in blood.
- FRUITS AND VEGETABLES: give us many vitamins and minerals, carbohydrates and fiber. Vitamins and minerals help keep our skin, eyes, hair healthy. They also help us fight diseases.
- MILK: gives us calcium, vitamin D and protein. Kids 9 and older need 3 cups of milk or equivalents to have strong bones and teeth.
- MEAT AND BEANS: are rich in many nutrients, proteins, iron, zinc, vitamin B. They are important for our muscles, our blood and mostly to grow up healthy and strong (blocks of cement to build our muscles and bones). Always choose low fat meats, skinless chicken, more beans and fish.
- FAT: provide energy and vitamins A, E, D, K. There are good and bad fats. Good fats include olive oil, nuts, olives, avocados. Bad fats include butter, mayonnaise and ghee. Too much fat will give too much energy, if not used can cause weight gain. Too much bad fats can be harmful to the heart and the arteries.
- EXTRAS: candies, chocolate, chips, cookies, ice cream. Contain too much fat and sugar and no nutrients (no vitamins, minerals, protein…) we have to limit intake to once or twice a day only. Too much of these foods can cause some problems as overweight and dental caries.

Activity: Food counter box

Materials needed:
- 2 Posters: Food groups and Role of food groups
- Pamphlet role of food groups
- Wooden boxes
- Back of the box: laminated paper showing 4 groups (Fruits, Vegetable, Milk, and Extras)
- Beads (4 different colours: red, green, blue, and pink)
- Threads
- Stapler
- Food counter box model

Activity plan:

- Distribute the wooden box, and the laminated paper
- Let the students write their name on their own boxes
- Cut the threads (around 1 meter long) and distribute them
- Distribute the beads (5 red, 5 green, 4 blue, and 2 pink)
- Staple the laminated paper to the back of the box
- Show the students the model and teach them the way to do it
- Explain to students how to use the food counter every day

Lesson Plan: What is a portion

Objectives:

At the end of the session, children will be able to:

- Know what is a food portion
- Know the serving size of foods in different food groups.

Points to discuss in class:

Knowing how much to eat.

- Kids need to eat different amounts of servings from each food group.
- Some kids need more servings specially those who are active in sports and play.
- Children need to know that how much they eat is entirely up to them, the best way to know that is to listen to their bodies and eat only when they are hungry(not bored or sad).
- Discuss the portion size of foods for each food group and help the child visualize it by experimenting it and compare it to his actual food portions.
- Discuss the concept of dietary excess: how we need to limit foods that are high in sugar and fat (one or 2 servings on most days) and why it is important to eat them in moderation.

Activity: Measuring centres

Materials needed:

- Poster: Serving size of foods and servings per day
- Pamphlet for serving size and servings per day
- Food diary (homework)
- Plastic plates, plastic cups, plastic spoons
- Foods from all food groups:
  White Arabic bread, Brown Arabic bread, French bread,
  Toast, Cornflakes, Pasta (boiled), Potato (boiled)
  Strawberry, Banana, Apple, Orange, Tomato,
  Cucumber, peas and carrots, juice
  Milk, White cheese, yellow cheese
  Nuts
  Biscuits, Chocolate, Candies, popcorn, potato chips

Activity plan:

- Display foods by food groups on counter or desk
- Ask children to come up 2 by 2 to display desk
- Ask each student to fill the plate or cup by his/her actual intake of a specific food and compare it to the appropriate portion size of this food
- Remind the children how much to eat from each group during the activity

Lesson plan: Fruits and vegetables the rainbow colours

Objectives:
At the end of the session, children will be encouraged to
- Eat more fruits and vegetables.
- Try new varieties of fruits and vegetables.

Points to discuss in class:

Fruits and vegetables: the rainbow colours
- Fruits and vegetables are rich in fibres, vitamins, minerals and phytonutrients.
- Phytonutrients are neither vitamins nor minerals but are found naturally in plants; they give fruits and vegetables their beautiful colours and work with vitamins and minerals to protect our body from many diseases.
- Fruits and vegetables are rich in water and low in calories.
- Include the 5 colour groups daily - red, yellow/orange, white, green, and blue/purple.
- We need to eat at least 5 fruits and vegetables a day to get all these benefits.

Activity: Mr Cocktail

Materials needed:
- Fruits and vegetables of different colours(rainbow colours)
  Body: Orange or apple
  Head: tangerine or kiwi
  Arms and legs: cherry tomatoes or strawberries
  Green peas, mint leaves, raisins, cauliflower (eyes, nose, hair…)
- Toothpicks, Plastic plates and bags

Activity plan:

- Display fruits and vegetables by type and colour on counter or desk
- Distribute plates and toothpicks to children
- Be careful with safety when giving toothpicks to children
- Ask children to come up 2 by 2 to display desk to choose food items
- If time is short or very limited, the instructor or teacher can distribute food items to children
- Make sure to show the fruit character to children to use as a model, however, they can also use their imagination and be creative.
- When the activity is over, wrap each character in a take away plastic bag

Lesson Plan: importance of Breakfast

Objectives:

At the end of the session, children will be encouraged to
- Never skip the breakfast meal
- Plan and prepare their own breakfast

Points to discuss in class:

Importance of Breakfast: Children need breakfast for many reasons

1. Wake up your brain: do better in school, play better.kids who eat breakfast have an easier time concentrating on learning, work faster, make fewer errors, score higher on tests and are more creative. That isn't all...Breakfast eaters are better behaved in the classroom and are less likely to be absent from school!
2. Breakfast is an important meal that gives the needed energy after 8 or 10 hours of fast during the night.
3. Children who skip breakfast tend to eat more foods high in fat and sugar during the day.
4. Children who skip breakfast regularly might not consume a milk portion during the day and could be at risk of developing calcium deficiency.
5. Studies show that childhood obesity is associated with less energy intake during breakfast.

Activity: Breakfast preparation

Materials needed:
- Poster: Food groups
- Poster: “Do not enter without Breakfast”
- Breakfast pamphlet
- Breakfast plan hand-out
- Foods for breakfast preparation:

Bread: Arabic white, Arabic whole grain,
French bread, toast, Cornflakes
Labneh, Cheese, Foul
Manoucheh, Croissant
Vegetables: cucumber, tomato
Fruits: apple, banana
Juice, Milk

Activity plan:
- Distribute the hand-outs and let the students plan 3 different breakfast meals
- Arrange the foods on the table and show the students how to prepare different breakfast options made of at least 3 food groups
  Ex: bread + labneh + cucumber

Lesson Plan: Healthy Snacks

Objectives:

At the end of the session, children will be encouraged to

- Differentiate between healthy snacks and non-stop-nibbling.
- Prepare healthy snacks at home

Points to discuss in class:

Importance of snacks: snacking has taken recently a bad connotation because it is related to low nutrient foods. However, done correctly, snacks can contribute a lot to a daily good nutrition.

- A snack should be taken regularly, preferably mid-afternoon to prevent nibbling after lunch and just prior to dinner.
- Healthful snacks should mirror meals, emphasizing healthy foods, but in smaller quantities.
- Healthy snacks, usually one or two a day should not be mixed up with “non-stop snaking” or nibbling that are usually constituted of foods rich in sugars and fats.
- Healthy snacks should be composed of 2 or 3 of the following: fresh or dried fruits, milk or cheese, bread or crackers, vegetables and nuts.
- Every now and then a sweet treat can be offered (chocolate, biscuits, ice cream…), better to choose nutrient rich varieties: milk or rice pudding, carrot cake, sfouf, honey or jam.

Activity: Snack preparation

Trail Mix

Materials needed:
- Poster: Food groups
- Snack pamphlet
- Small plastic Bags, Ribbon, Plastic Spoons ,Food containers
- Recipe for fruit smoothie
- Foods for snack preparation:
  Dried fruits: apricot, dates, raisin
  Nuts: walnuts, pine nuts, sunflower seeds
  Cornflakes

Activity plan:
- Cut the ribbon (approximately10 cm)
- Ask the teacher to distribute the bags
- Put each kind of food in a separate container
- Ask the students to come up and fill the bag with 1 tablespoon from each kind of food
- Close the bag with the ribbon

Fruit smoothie

Materials needed:

- Hand mixer
- Small plastic cups
- Low fat milk or yogurt
- Strawberries and bananas
- Vanilla, honey or brown sugar

Activity plan:

- Explain method of preparation of the smoothie recipe and prepare a sample for students to taste,
- Distribute the printed recipe and encourage trying it at home with different types of fruits.

Lesson Plan: Physical Activity

Objective:
At the end of the session, children will be encouraged to increase their daily physical activity for at least 30 to 60 minutes

Points to discuss in class

Fit Kids feel good, have lots of energy, and grow up healthy and strong.

Fit Kids are physically active every day.

It doesn't matter what they do, they just have to move! 30 to 60 minutes a day.

Benefits of exercise: what does physical activity do to our body?

- Physical activity gets lots of oxygen to the brain so we can think clearly and do our best.
- Physical activity builds strong muscles and bones, it helps the body stay in good shape and keep a healthy weight.
- Running, walking and dancing keep the heart strong. A strong and healthy heart pumps oxygen and blood from the head to the toes.
- Playing outside and breathing fresh air keeps the lungs in great shape.

Activity 1: Active vs. Sedentary List

Materials needed:
- Poster: Be a fit kid
- Pamphlet exercise
- Weekly activity diary (homework)
- Post-it
- Large cartoon (draw a line in the middle. Write Active at the first part, and Sedentary at the second)

Activity plan:

- Give 4-5 Post-it to each student
- Ask children to write the activities done during weekend or the previous day (active or sedentary activities) on each Post-it
- Ask each student to come up, read out loud the activities, and post them on the appropriate part of the cartoon
- At the end, compare the two parts of the cartoon
- Distribute the weekly activity diary for students to fill in their daily physical activity at home with their parents

Activity 2: Pedometer workshop

Materials needed:

- Poster: Be a fit kid
- Pedometers
- Gifts: jumping ropes, footballs (Reinforcement/for completion of activity diary)

Activity plan:

- Distribute pedometers to students and give instructions on how to use it
- Ask children to put on the pedometers and go to playground to do the outdoor activities (walking, running, football, etc.…)
- Encourage them to move as much as they can to increase the steps counter on the pedometer in order to reach 10,000 steps a day.
- Leave pedometers with students and encourage them to count their steps everyday.
- Distribute balls and jumping ropes to students upon completion of activity diary and step counting.

Lesson Plan: Water is the best

Objectives:

At the end of the session, children will be able to:

- To explain why water is the best
- Will find ways to increase water intake instead of soft drinks

Points to discuss in class

- Drink water as much as possible
- Water is the only fluid needed by our body
- Water is rich in many minerals: sodium, potassium, magnesium
- Water has no calories
- Your body loses water every day
- Sodas, artificial juices and fruit nectar have a lot of sugar and cannot replace water.

Activity: Water workshop

Materials needed:

- Poster: Water is the best
- Pamphlet Water is the best
- Plastic cups
- Water bottles
- Soft drink can
- Fresh juice
- Artificial juice
- Sparkling water
- Sugar cubes

Activity plan:

- Display water bottle and soft drink can with appropriate amount of sugar next to soft drink
- Compare sugar content between soft drinks, natural and artificial juice and water
- Prepare the orange fizz drink by mixing half fresh juice and half sparkling water
- Pour in cups and give to students to taste

Lesson Plan: Clean teeth, good teeth

Objectives:

At the end of the session, children will be able to know:

- The correct way of tooth brushing
- What are the best foods and tools for strong and carries free teeth
- That what they eat, and the way they eat affects their teeth

Points to discuss in class

- Our teeth are very important; they chew food, help us speak clearly and give us a great smile!
- To have clean teeth, free of caries, you need to brush your teeth everyday after eating.
- Sticky foods like: candies, lollipops, toffee and caramel bars stick on your teeth.
- Sodas, juices, lemonade and syrups have a lot of sugar and should be consumed sparingly.
- Visit to dentist every 6 months

Activity: Tooth experiment/ correct way of tooth brushing

Materials needed:

- Poster: Clean teeth
- Pamphlet clean teeth
- Soda
- Tooth
- Glass jar
- Toothbrush
- Jaw
- Sticky foods: candies, lollipops, Caramel and toffee bars
- Dental floss
- Gifts: toothbrush, toothpaste

Activity plan:

- Place the tooth inside the jar, put soda, and close the jar tightly (check the condition of the tooth after 1 or 2 weeks, tooth enamel should deteriorate)
- Show the sticky foods and explain how easily they can stick on the teeth
- Demonstrate the correct way of tooth brushing using the toothbrush and the jaw
- Demonstrate proper use of the dental floss
- Ask students to come in turn to brush the jaw

Lesson Plan: where do fats and sugars hide?

Title of the session: sugars and fats hide in many foods

Objectives:

At the end of the session, children will be able to:

- Identify high fat, high sugar containing foods

Activity: Treasure game

Materials needed:

- Board game poster
- Fat chart poster and pamphlets
- Magnetic board and magnets
- Food cards
- Big dice
- Jumping rope/ ball

Activity plan:

- Children divided in two groups. Each group should follow a track along a list of food stations to reach the treasure according to the throw of a dice (make a very large one).
- The list of foods on the track includes: sweets, biscuits, candies, fries, chips, pastries…and fruits, vegetables, water…
- Each time one of the groups stops on a food station, he should check and accumulate the sugar and fat content of that food.
- The group that reaches the treasure with the least number of teaspoons from sugar and fats wins the game.
- Bonus: sports station: a way to lose some of the accumulated bad points.(rope jumping, ball)
- At the end of the session distribute the Fat chart pamphlets to students

Lesson Plan: Value of food

Objectives:
At the end of the session, children will be able to compare foods according to their nutrients and energy content.

Points to discuss in class

- Discuss energy density and nutrient density
- Explain the difference between foods rich in nutrients and foods rich in calories but empty of nutrients
- Classify foods according to Traffic light code in terms of nutrient density

Activity: The traffic light game

Materials needed:
- Food cards
- Poster Traffic lights
- Traffic lights coloured cardboards on wooden sticks (3 sets)

Activity plan:

- Distribute food cards among children
- Divide classroom into 3 groups
- Give one set of cardboards to each group
- Groups take turns in classifying foods on food cards according to traffic lights code
- The group with the most correct answers wins the game.

Appendix E: Educational material

Posters

Pamphlets

Booklets

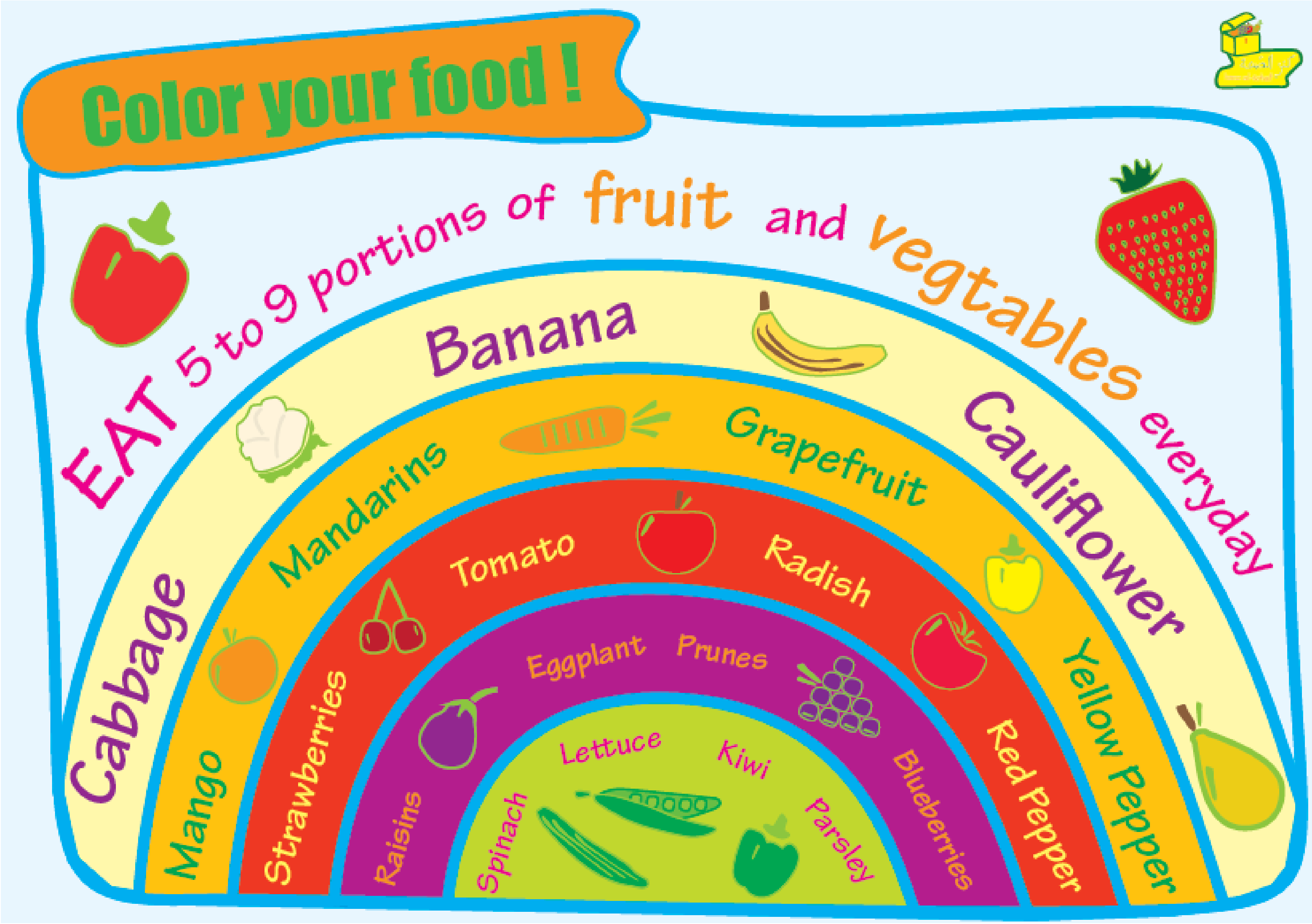
Food cards

Posters


My Food Groups
Fruits and Vegetables
الخضار والفاكهة
Grains
الحبوب
Fat and Oil
الدهون
Meats and Beans
اللحوم والبقول
Milk
الحليب
Extras
الاكسترا
مجموعاتي الغذائية


Food Benefits
VITAMIN A,B,C
STRONG
HEALTHY
فيتامينات
لجسم صحي
و بعيدعن الأمراض
ENERGY
BRAIN
PLAY
RUN
نشويات
طاقة
للتركيز
لنلعب
ولنركض
BUTTER
VITAMIN D
VITAMIN E
ENERGY
TO PLAY
فيتامين
طاقة
لنلعب
OIL
PROTEIN
GROWTH
MUSCLES
بروتين
عضلات
نمو
كالسيوم
لأسنان سليمة
و عظام قوية
CALCIUM
STRONG BONES
& TEETH
SUGARS
FATS
CARIES
WEIGHT GAIN
سكر
دهون
وزن زائد
أسنان مسوسة
منافع الغذاء


How much to eat ?
Portions per day
What's a portion?
Grains
6
Fruits and Vegetables
5
Milk
3
Meats and Beans
2
Fat and Oil
4
or less
OIL
BUTTER
Extras
2


Color your food !
EAT 5 to 9 portions of fruit and vegtables everyday
Banana
Cauliflower
Cabbage
Mandarins
Grapefruit
Yellow Pepper
Mango
Tomato
Radish
Red Pepper
Strawberries
Eggplant
Prunes
Blueberries
Raisins
Lettuce
Kiwi
Parsley
Spinach


Drink Water !
Water is the only fluid needed by our body
الماي أحلى شي
ماي عبكرا
ماي عشية
ماي للغذاء والعصرونية
70 %
٧٠ ٪
الماء هو السائل الوحيد
الذي يحتاجه جسمنا
I am thursty for water
70% of our body is water
Water
يجب أن تشرب الماء
مع كل الوجبات
DRINK WATER AS MUCH AS YOU CAN
I like juice, I like tea,
I like water aktar chi!
الماء أحلى شي


I am a Fit Kid
To be a FIT KID, move 30 to 60 minutes everyday
Play and run with friends!
ألعب وأركض مع الرفاق!
أركب الدراجة أو السكايت
Ride your bike or rollers!
Dance, swim, play football!
أسبح، أرقص، ألعب كرة القدم
أمارس نشاط جسدي من نصف ساعة الى ساعة يوميا"
انا بطل !

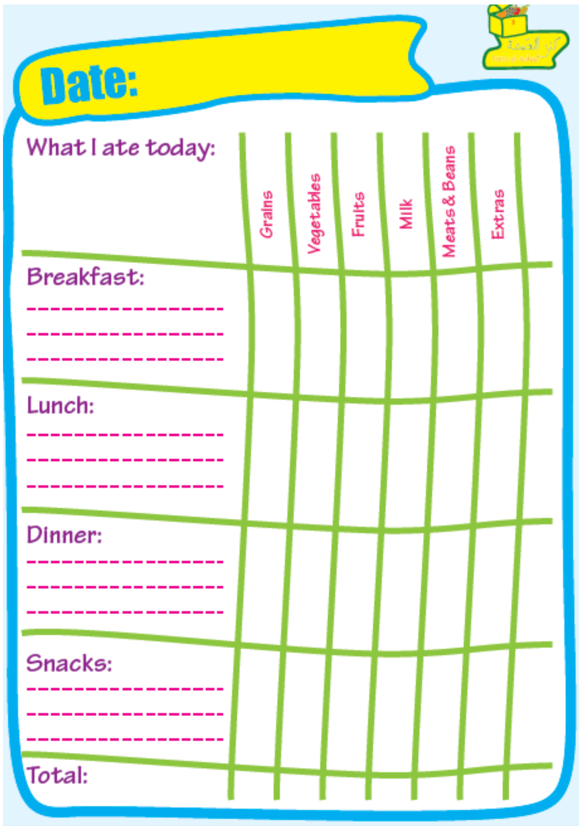

Clean Teeth, Good Teeth
"the clean mouth friends"
"أصدقاء الأسنان النظيفة"
TOOTHPASTE
DENTAL FLOSS
"the sticky guys"
"سكر بيدبق
سكر بيلطق"
Soda
Juice
أسنان نظيفة، أسنان قوية

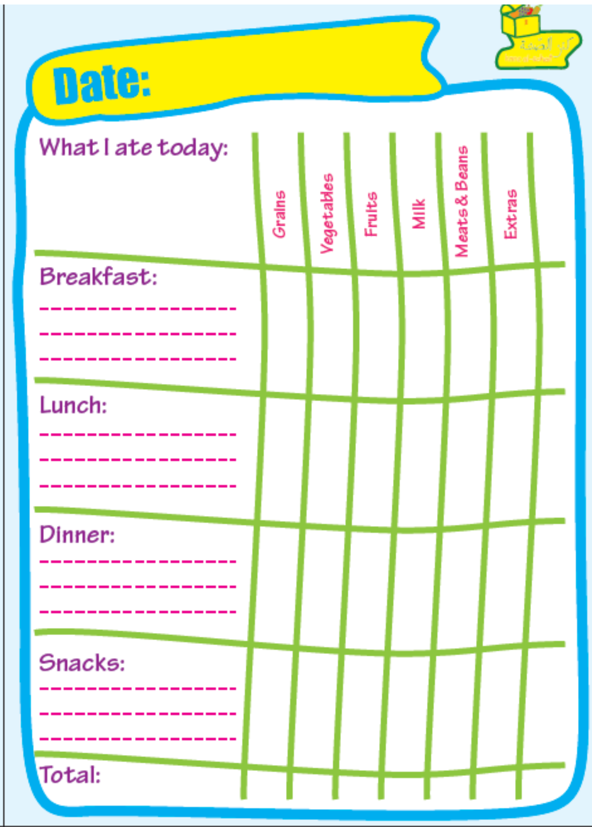

Treasure Game
أنا نشيط كل يوم!
BONUS
BONUS
FINISH
START
Color your food with fruits and vegetables!
لعبة الكنز

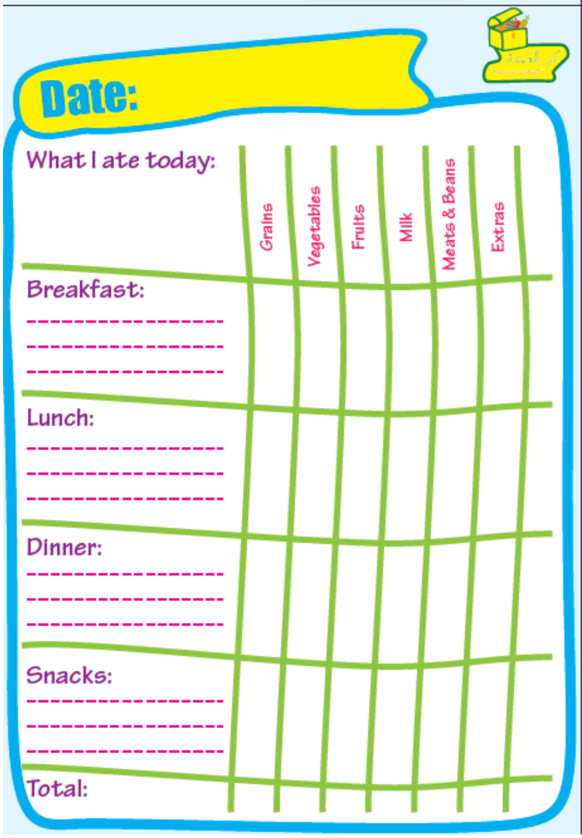
Treasure Chart
= spoons of fat
ملاعق دهون
= spoons of sugar
ملاعق سكر
= 8
= 5
4
= 3
= 3
= 2
= 4
1
= 4
2
= 4
= 4
3
= 2
3
= 3
= 5
= 7
= 6
4
خريطة الكنز

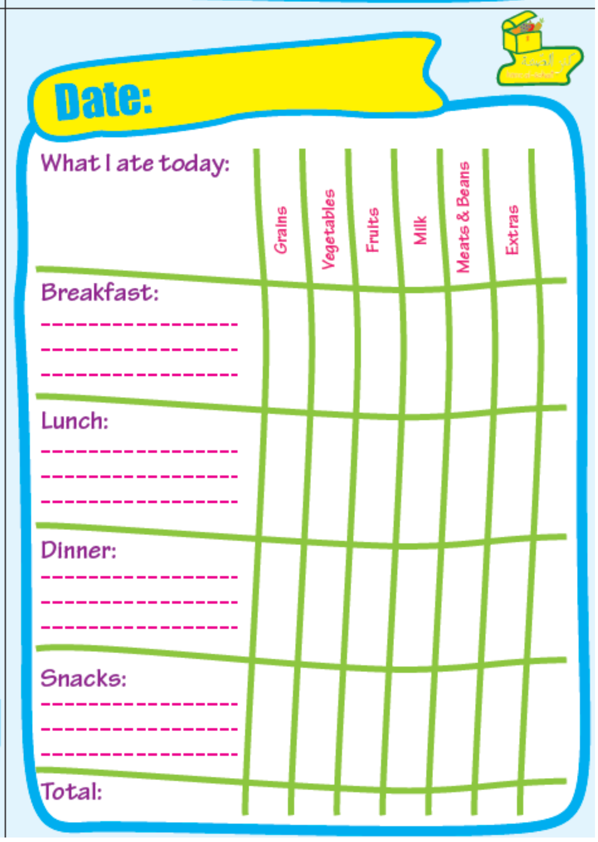

Traffic Lights !
Follow the traffic lights code when choosing your foods.
Sodas and sweet beverages
Chips
Fries
Donuts
croissant
المشروبات الغازية
التشيبس
البطاطا المقلية
الدوناتس
الكرواسان
Soda
Juice
Chocolate
Sweet cornflakes
العصير
الشوكولا
الكورن فلاكس
Juice
Oranges
Tabouli
Fat free milk
Fish
Eggs
البرتقال
التبولة
الحليب الخالي الدسم
السمك
البيض
للصحة إلحق الإشارة،
عالأحمر نصاحة يا خسارة
عالأخضر في موزة
وتفاحة وخيارة
إلحق الإشارة

Food Diary


Date:
What I ate today:
Grains
Vegetables
Fruits
Milk
Meats & Beans
Extras
Breakfast:
Lunch:
Dinner:
Snacks:
Total:


Date:
What I ate today:
Grains
Vegetables
Fruits
Milk
Meats & Beans
Extras
Breakfast:
Lunch:
Dinner:
Snacks:
Total:


Date:
What I ate today:
Grains
Vegetables
Fruits
Milk
Meats & Beans
Extras
Breakfast:
Lunch:
Dinner:
Snacks:
Total:


Date:
What I ate today:
Grains
Vegetables
Fruits
Milk
Meats & Beans
Extras
Breakfast:
Lunch:
Dinner:
Snacks:
Total:

Activity Booklet

Food cards


Hommos
حمص
Chich Taouk
شيش طاووق
Salad
سلطة
Green Peas
بازيلا
Mortadella
مرتدلة
Chips
التشيبس
Tabbouleh
تبولة
Chicken Nuggets
قطع الدجاج(ناغتس)
Eggs
بيض


Oranges
برتقال
Fries
NATURAL-CUT
FRIES
بطاطا مقلية
Kebbeh
كبة
Grilled Chicken
دجاج مشوي
Baked beans
فول متبل
Whole wheat bread
توست (خبز)
Mou3ajjannat
معجنات
Mtabbal
متبل باذنجان (بابا غنوج)
Hot Dog
هوت دوغ

Pamphlets

My Food Groups

Fruits and Vegetables

Fruits and Vegetables are rich in vitamins.

What is the role of vitamins?

• They protect us from diseases
• They help us stay strong and healthy

Grains

Foods in the grains group are rich in carbohydrates.

What is the role of carbohydrates?

• They give energy to our muscles so we can run or play
• They give power to our brain

Meats and Beans

Foods in the meat group are rich in proteins

What is the role of proteins?

• They allow us to grow and build muscle

Milk

Milk, yogurt and cheese are rich in calcium

What is the role of calcium?

• Calcium is important to build strong bones and teeth.

OIL

Fat and Oil

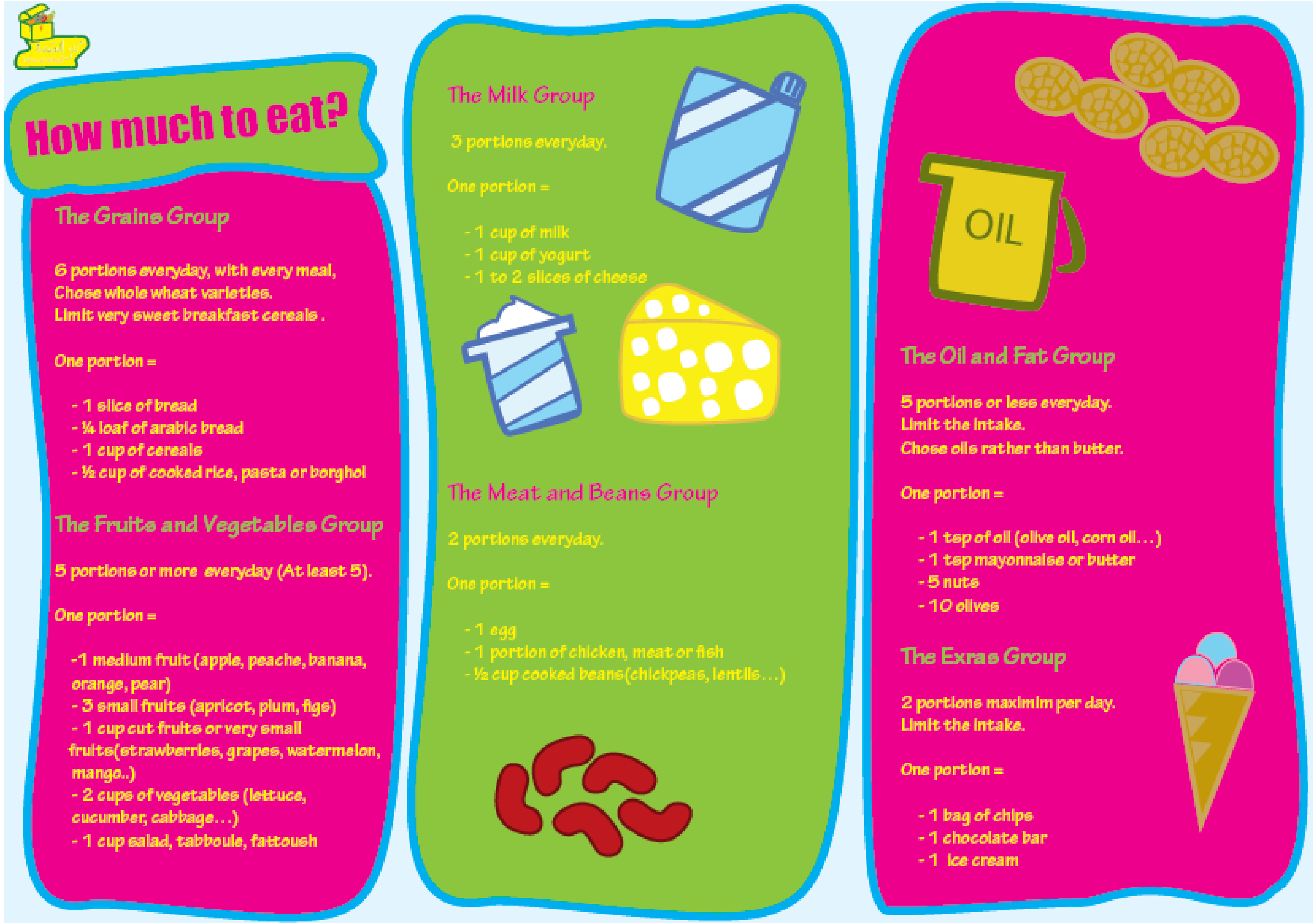
Foods in the oil group are rich in fat

What is the role of fat?

•It gives us energy to run or play
•It is rich in vitamins

Extras

Chips, cookies, chocolate, donuts, candies, ice cream, sodas and artificial juices….
• Foods in this group contain too much fats and sugars and very little nutrients if any.
• Too much of those foods can make us gain weight and cause caries


How much to eat?
The Grains Group
6 portions everyday, with every meal,
Chose whole wheat varieties.
Limit very sweet breakfast cereals .
One portion =
- 1 slice of bread
- ¼ loaf of arabic bread
- 1 cup of cereals
- ½ cup of cooked rice, pasta or borghol
The Fruits and Vegetables Group
5 portions or more everyday (At least 5).
One portion =
-1 medium fruit (apple, peache, banana, orange, pear)
- 3 small fruits (apricot, plum, figs)
- 1 cup cut fruits or very small fruits(strawberries, grapes, watermelon, mango..)
- 2 cups of vegetables (lettuce, cucumber, cabbage…)
- 1 cup salad, tabboule, fattoush
The Milk Group
3 portions everyday.
One portion =
- 1 cup of milk
- 1 cup of yogurt
- 1 to 2 slices of cheese
The Meat and Beans Group
2 portions everyday.
One portion =
- 1 egg
- 1 portion of chicken, meat or fish
- ½ cup cooked beans(chickpeas, lentils…)
OIL
The Oil and Fat Group
5 portions or less everyday.
Limit the intake.
Chose oils rather than butter.
One portion =
- 1 tsp of oil (olive oil, corn oil…)
- 1 tsp mayonnaise or butter
- 5 nuts
- 10 olives
The Exras Group
2 portions maximim per day.
Limit the intake.
One portion =
- 1 bag of chips
- 1 chocolate bar
- 1 ice cream

Color your Food !

Fruits and Vegetables are very beneficial:
They are rich in water
They are rich in minerals and vitamins like vitamin A, B & C
They contain phytochemicals

What are phytochemicals?

The word phytochemical is pronounced:

"FIGHT-O-CHEMICALS"

Phytochemicals are neither vitamins nor minerals, but they work with vitamins and minerals to keep our body healthy.
They are found in all plants and give fruits and vegetables their beautiful colors.

Phytochemicals give fruits and vegetables 5 beautiful colors:

Green: lettuce, cucumber, spinach, green beans, peas, parsley, kiwi, green pepper…

White: Cabbage, cauliflower, banana, pear, white prunes…

Yellow and Orange: Citrus, orange, grapefruit, mandarins, mango, papaya, yellow pepper, melon…

Purple blue: cherries, red grapes, blueberries, raisins, eggplant, red cabbage, plums, prunes …

Red: strawberries, tomato, red apple, water-melon, radish, red pepper…

Eat your 5 colors ever day. For example:

BREAKFAST: Orange wedges (yellow/ orange)

LUNCH: purple grapes (purple blue) - cucumber and lettuce (green) – tomato slices (red)

DINNER: green beans (green), strawberries (red)

SNACKS: carrot (yellow-orange)– banana (white)

I am a Fit Kid !

Exercise is very important to our body:

-It gives oxygen to our brain so we can think clearly
-It helps us build strong muscles and bones
-It keeps the body in a good shape and weight
-It keeps our heart and lungs strong

You should exercise for at least 30 minutes every day.

Choose any of these fun fitness activities:

-Play and run with your friends.
-Play hide and seek or the tag game
-Walk your dog or walk with you parents

-Go for a ride on your bike, roller-blades or skateboard
-Go skiing in the winter
-Go swimming in the summer
-Become stronger, try Karate, Judo or Taekwondo
-Jump using a jump rope
-Play basketball or football
-Or simply dance!

Yummy Breakfast

Breakfast is the most important meal of the day for many reasons:

- It gives energy for your body after fasting during the night
- It wakes up your brain and helps you do better in school to get higher scores.

You can choose a healthy breakfast from the following choices:

Weekdays				Weekend	Holiday
sweet breakfast	lebanese breakfast	salty breakfast	fast breakfast	manoushe day	hot breakfast
-A cup of milk -Bread -White cheese with jam and/ or honey -1 fruit	-Bread -Labneh with thyme and olives -A cup of milk -1 fruit	-Bread -White cheese and cucumber -A cup of Milk -1 fruit	-Milk and cornflakes -Dried fruits (raisins, apricots, dates) -or 1 fresh fruit	-Mankoushe Zaatar or cheese -Tomatoes -1 fruit	-Boiled or fried eggs -Bread -Tomatoes -1 cup of juice Or -Bread with foul and tomatoes -1 cup of yogurt

Additional Tips:

- Always choose multicereal (i.e. brown) bread
- If you are not feeling hungry in the morning, you can eat your sandwich on your way to school or just before classes start.

Snack Attack

Why are snacks important?

Snacks are an important way to keep our body full of energy all day long.

Snacks prevent the feeling of hunger between meals, especially between lunch and dinner.

When should I have a snack?

A healthy snack in mid-afternoon is better than nibbling anything, anytime, and spoil your appetite for dinner.

You can, of course skip the snack if you are not hungry. But if you are, don't hesitate to enjoy this mini meal.

PETIT BEURRE

Think of snacks as small meals made of the same healthy foods as breakfast, lunch or dinner.

Choose one food from 2 or 3 food groups:

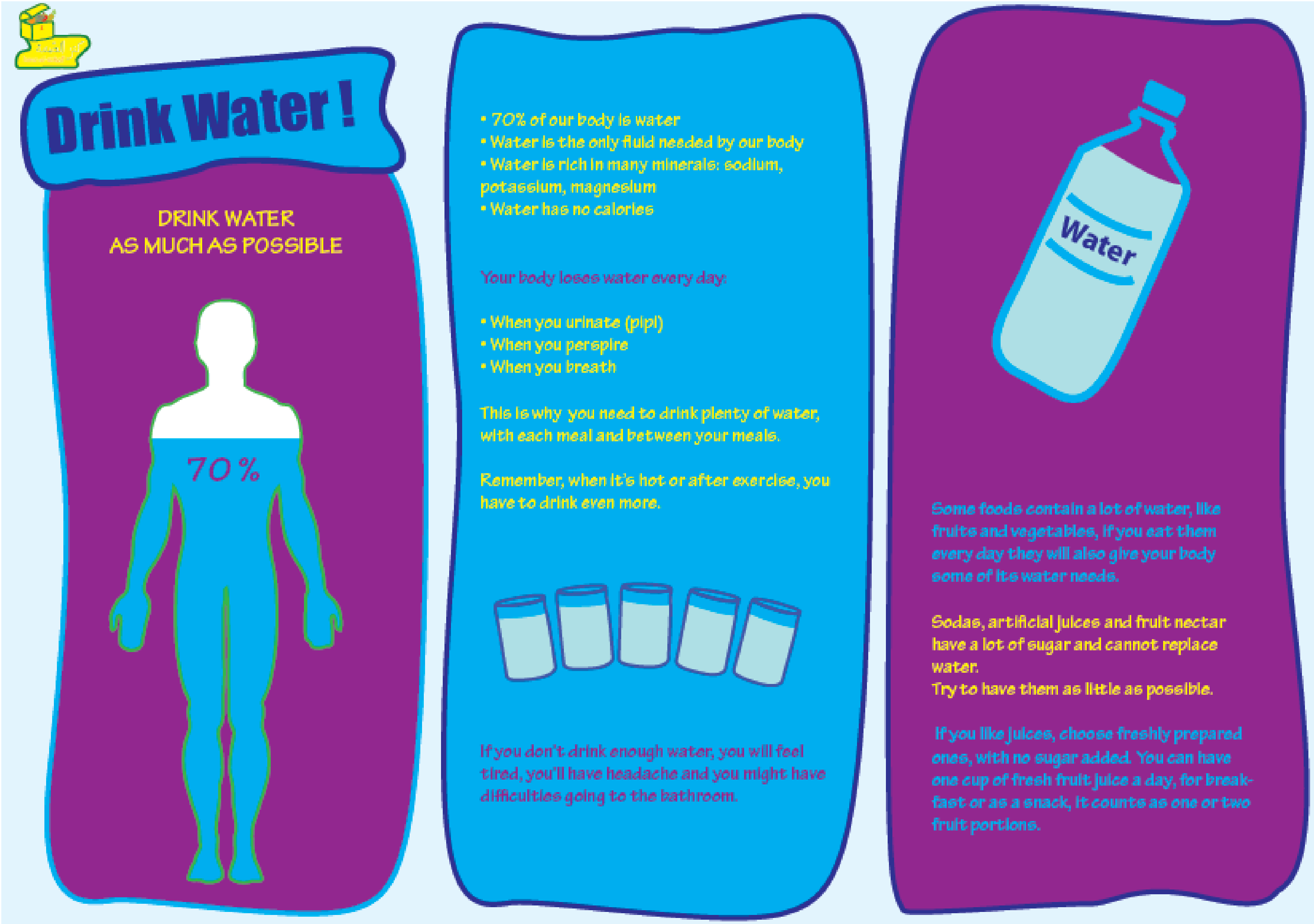
- Fresh fruits, or fruit salad, or few pieces of dried fruits or fresh fruit juice.
- One cup of milk, or yogurt, cheese or labne.
- One slice of bread, or pretzels
- Carrot sticks, cucumber slices, tomatoes, corn on the cub.
- Don't forget to drink plenty of water.

CHOCO CREME

You can have a chocolate bar or a cookie from time to time, but remember, sodas, chips , croissant and donuts are foods that have no vitamins or minerals.

Try one of the following as healthy sweet snack:

- Chocolate custard
- Milk pudding or rice pudding
- Carrot , banana or apple cake or muffin or sfouf
- Jam, honey or chocolate with crepe or pancakes.
- Cup of boiled wheat with nuts and raisins.


Drink Water !
DRINK WATER
AS MUCH AS POSSIBLE
70 %
• 70% of our body is water
• Water is the only fluid needed by our body
• Water is rich in many minerals: sodium, potassium, magnesium
• Water has no calories
Your body loses water every day:
• When you urinate (pipi)
• When you perspire
• When you breath
This is why you need to drink plenty of water, with each meal and between your meals.
Remember, when it's hot or after exercise, you have to drink even more.
If you don't drink enough water, you will feel tired, you'll have headache and you might have difficulties going to the bathroom.
Water
Some foods contain a lot of water, like fruits and vegetables, if you eat them every day they will also give your body some of its water needs.
Sodas, artificial juices and fruit nectar have a lot of sugar and cannot replace water.
Try to have them as little as possible.
If you like juices, choose freshly prepared ones, with no sugar added. You can have one cup of fresh fruit juice a day, for break-fast or as a snack, it counts as one or two fruit portions.

Clean Teeth, Good Teeth

Our teeth are very important; they chew food, help us speak clearly and give us a great smile!

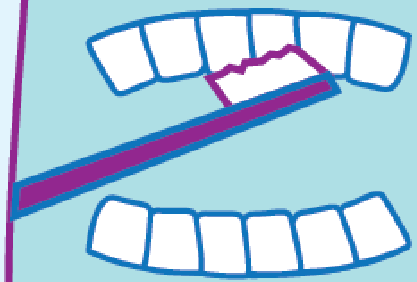
When you eat, small pieces of food are left between your teeth. The Bacteria in the plaque use this food, especially sugar to form ACIDS.

This acid attacks the white covering of your teeth and causes CARIES (AIE)!

To have clean teeth, free of caries, you need to bush your teeth everyday after eating.

When brushing your teeth, always remember to clean all your teeth, front, back, in and out for at least two minutes.

Remember to floss everyday. Move the floss around each tooth so it forms the letter "C", scrap up and down.



Change your toothbrush every 3 months

The way you eat, and what you eat also affects your teeth.

Sticky foods like: candies, lollipops, toffee and caramel bars stick on your teeth.

Sodas, juices, lemonade and syrups have a lot of sugar too.

Try not to eat them very often, not more than once a day. One more thing, when you're having a juice or a soda, use a straw and don't let the liquid touch your teeth.

Finally, do you know who your teeth best friend is? It's your dentist; you have to go see him every 6 months to examine your teeth and check if they are caries free.

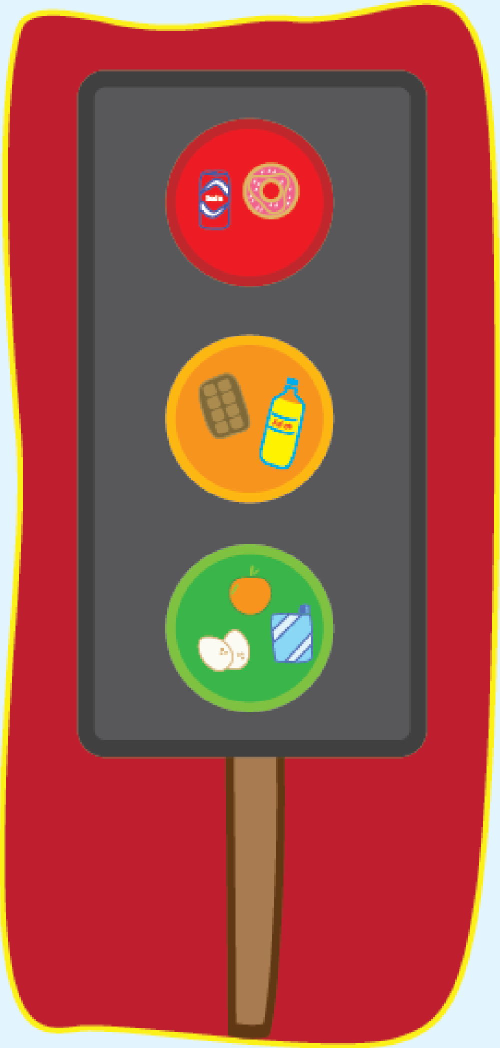
Traffic Lights !

Follow the traffic lights code when choosing your foods.

Foods and nutrient content

Nutrient rich foods give you a lot of vitamins, minerals and other nutrients, for the fewest calories:

-Brightly colored fruits and vegetables
-Whole-fiber rich grains
-Fat free and low fat milk, cheese and yogurt
-Lean mat, skinless poultry, fish, eggs, beans and nuts



Red/ stop foods:

- Sodas and sweet beverages
- Chips
- Fries
- Donuts
- Croissant

Orange/ slow foods:

- Juice (made from concentrate)
- Chocolate
- Sweet cornflakes

Green/ Go foods:

- Oranges
- Tabouli
- Fat free milk
- Fish
- Eggs

Appendix F: Raw (R) and Collapsed (C) data

Table5.3 R: Frequencies of students' behaviours Pre and Post intervention / Dietary habits

Dietary Habits	Baseline		Post Intervention	
	Intervention (n=193)	Control (n= 181)	Intervention (n=193)	Control (n=181)
	% (n)		% (n)	
Do you usually have Breakfast				
Everyday	71.4 (137)	63.0 (114)	76.5 (143)	48.0 (84)
Sometimes	26.6 (51)	33.1 (60)	21.4 (40)	45.1 (79)
Never	2.1 (4)	3.9 (7)	2.1 (4)	6.9 (12)
How many snacks per day				
Once	39.9 (75)	37.9 (67)	47.6 (88)	38 (63)
Twice	37.9 (67)	19.2 (34)	30.3 (56)	30.1 (50)
3 or more	44.2 (83)	42.9 (76)	22.1 (41)	31.9 (53)
Do you eat while watching TV				
All the time	18.1 (35)	14.4 (26)	9.6 (18)	16 (28)
Sometimes	60.1 (160)	70.7 (128)	66.5 (125)	69.7 (122)
No	21.8 (42)	14.4 (27)	23.9 (45)	13.7 (24)
How many times do you eat out per week				
Three or more	15.8 (30)	17.7 (32)	13.9 (26)	19.5 (34)
Once or twice	62.6 (119)	54.7 (99)	62.6 (117)	60.9 (106)
Never	21.6 (41)	27.6 (15)	23.5 (44)	19.6 (34)

Table 5.3C: Frequencies of students' behaviours Pre and Post intervention / Dietary habits(collapsed)

Dietary Habits	Baseline		Post Intervention	
	Intervention (n=193)	Control (n= 181)	Intervention (n=193)	Control (n=181)
	% (n)		% (n)	
Do you usually have Breakfast				
Everyday	71.4 (137)	63.0 (114)	76.5 (143)	48.0 (84)
Not Everyday	28.7 (55)	37 (67)	235 (44)	52 (91)
How many snacks per day				
One or Two	55.9 (107)	57.1 (100)	77.9 (146)	68.1 (119)
Three or more	44.1 (85)	42.9 (76)	22.1 (41)	31.9 (56)
Do you eat while watching TV				
Yes	18.1 (35)	14.4 (26)	9.6 (18)	16 (28)
No	155.8 (155)	81.9 (202)	83.4 (146)	90.4 (170)
How many times do you eat out per week				
Three or more	15.8 (30)	17.7 (32)	13.9 (26)	19.5 (34)
Sometimes	84.2 (160)	82.3 (114)	86.1 (161)	80.5 (140)

Table 5.11 R: Frequencies of students' behaviours Pre and Post intervention / screen time

Screen time	Baseline		Post Intervention	
	Intervention (n=193)	Control (n= 181)	Intervention (n=193)	Control (n=181)
	% (n)		% (n)	
Do you watch TV during week days				
a lot	31.2 (60)	29.3 (51)	30.1 (53)	32.2 (55)
a little	50.5 (97)	59.8 (104)	54.0 (95)	53.8 (92)
I don't	18.2 (35)	10.9 (19)	15.9 (28)	14 (24)
Do you watch TV during weekends				
all day	29 (56)	28.9 (52)	27.1 (51)	28.7 (50)
twice a day	26.9 (52)	39.4 (71)	26.1 (49)	31.0 (54)
once a day	37.8 (73)	28.9 (52)	38.8 (73)	37.9 (66)
I don't	6.2 (12)	2.8 (5)	8.0 (15)	2.3 (4)
Do you play electronic games after school				
every day for a long time	18.1 (35)	19.3 (35)	16.2 (30)	16.1 (27)
every day for a short time	40.9 (79)	40.3 (73)	44.9 (83)	39.9 (67)
3 or more times a week	24.4 (37)	21 (38)	19.5 (36)	22.0 (37)
I don't	16.6 (32)	19.3 (35)	19.5 (36)	22.0 (37)
Do you play electronic games during weekend				
all day	19.8 (38)	25.6 (46)	20.9 (39)	23.6 (41)
twice a day	28.6 (55)	24.4 (44)	28.3 (53)	25.9 (45)
once a day	39.6 (76)	37.8 (68)	36.9 (69)	36.2 (63)
I don't	12.0 (23)	11.7 (21)	13.9 (26)	14.4 (25)

Table 5.11 C: Frequencies of students' behaviours Pre and Post intervention / screen time(collapsed)

Screen time	Baseline		Post Intervention	
	Intervention (n=193)	Control (n= 181)	Intervention (n=193)	Control (n=181)
	% (n)		% (n)	
Do you watch TV during week days				
Yes	31.2 (60)	29.3 (51)	30.1 (53)	32.2 (55)
No	68.7 (132)	70.7 (123)	69.9 (123)	67.8 (116)
Do you watch TV during weekends				
A lot	55.9 (108)	68.3 (123)	53.2 (100)	59.7 (104)
A little	44 (85)	31.7 (57)	46.8 (88)	40.2 (70)
Do you play electronic games after school				
Everyday	59 (114)	59.6 (108)	61.1 (113)	56 (94)
Not everyday	41 (69)	40.3 (73)	39 (72)	44 (74)
Do you play electronic games during weekend				
A lot	48.4 (93)	50 (90)	49.2 (92)	49.5 (86)
A little	51.6 (99)	49.5 (89)	50.8 (95)	50.6 (88)

Table 5.9 R: Frequencies of students' behaviours pre and post intervention/ physical activity habits

Exercise Habits	**Baseline**		**Post Intervention**	
	Intervention (n=193)	**Control (n= 181)**	**Intervention (n=193)**	**Control (n=181)**
	% (n)		**% (n)**	
Do you play at recess				
Yes	83.4 (161)	80.7 (146)	88.3 (166)	82.9 (145)
No	16.6 (32)	19.3 (35)	11 (22)	17.1 (30)
Do you play at home after school				
Yes	31.6 (61)	30.4 (55)	47.8 (89)	41.7 (73)
Sometimes	30.6 (59)	32.0 (58)	21.0 (39)	30.9 (54)
No	37.8 (73)	37.6 (68)	32.4 (60)	28.3 (49)
How many times you do sports after school or during weekend				
Three or more	39.2 (75)	40.9 (74)	61 (116)	55.8 (97)
Once or twice	46.3 (89)	48.1 (87)	32 (60)	32.8 (57)
I don't	14.6 (28)	11.0 (20)	5.9 (11)	11.5 (20)

Table 5.9 C: Frequencies of students' behaviours pre and post intervention/ physical activity habits (collapsed)

Exercise Habits	Baseline Intervention (n=193)	Baseline Control (n= 181)	Post Intervention Intervention (n=193)	Post Intervention Control (n=181)
	% (n)		% (n)	
Do you play at recess				
Yes	83.4 (161)	80.7 (146)	88.3 (166)	82.9 (145)
No	16.6 (32)	19.3 (35)	11 (22)	17.1 (30)
Do you play at home after school				
Yes	62.2 (120)	62.4 (113)	68.8 (128)	72.6 (127)
No	37.8 (73)	37.6 (68)	32.4 (60)	28.3 (49)
How many times you do sports after school or during weekend				
Yes	85.5(164)	89 (161)	93 (176)	88.6 (154)
No	14.6 (28)	11.0 (20)	5.9 (11)	11.5 (20)

Table 5.16 R: Frequencies of students' behaviours Pre and Post intervention / Health Beliefs

Beliefs	Baseline		Post Intervention	
	Intervention (n=193)	Control (n= 181)	Intervention (n=193)	Control (n=181)
	% (n)		% (n)	
The food you eat can affect your health				
Yes	49.2 (95)	50.8 (91)	70.7 (133)	49.4 (86)
No	26.9 (52)	24.6 (44)	16 (30)	22.4 (39)
I don't know	23.8 (46)	24.6 (44)	13.3 (25)	28.2 (49)
The foods you eat now are healthy				
Yes	66.8 (129)	71.9 (128)	82.41 (154)	69.5 (121)
No	7.8 (15)	10.1 (18)	6.41 (12)	8 (14)
I don't know	24.4 (47)	18 (32)	11.2 (21)	22.4 (39)
People who weigh more may have health problems				
Yes	75.6 (146)	81.6 (146)	81.4 (153)	81 (141)
No	5.7 (11)	5.6 (10)	7.4 (14)	4.6 (8)
I don't know	18.7 (36)	12.8 (23)	11.2 (21)	14.4 (25)

Table 5.16 C: Frequencies of students' behaviours Pre and Post intervention / Health Beliefs

Beliefs	Baseline		Post Intervention	
	Intervention (n=193)	Control (n= 181)	Intervention (n=193)	Control (n=181)
	% (n)		% (n)	
The food you eat can affect your health				
Yes	49.2 (95)	50.8 (91)	70.7 (133)	49.4 (86)
No	50.7 (98)	49.2 (88)	29.3 (55)	50.6 (88)
The foods you eat now are healthy				
Yes	66.8 (129)	71.9 (128)	82.41 (154)	69.5 (121)
No	28.1 (50)	32.2 (62)	17.6 (16)	30.4 (59)
People who weigh more may have health problems				
Yes	75.6 (146)	81.6 (146)	81.4 (153)	81 (141)
No	24.4 (47)	18.4 (33)	18.6 (35)	19 (33)

Appendix G: Descriptive tables by school type and gender

Table 5.3.1: Frequencies of students' behaviours Pre and Post intervention / Dietary habits by school type

Dietary Habits	Baseline				Post Intervention					
	Public		Private		Public			Private		
	Intervention (n=92)	Control (n=93)	Intervention (n=100)	Control (n=89)	Intervention (n=92)	Control (n=93)	*P value*	Intervention (n=100)	Control (n=89)	*P value*
	%(n)		%(n)		%(n)			%(n)		
Do you usually have Breakfast							< 0.001			< 0.001
Everyday	79.1 (72)	64.4 (58)	64.4 (65)	61.5 (56)	76.1 (67)	45.9 (39)		76.8 (76)	50 (45)	
Sometimes	18.7 (17)	31.1 (28)	33.7 (34)	35.2 (32)	19.3 (17)	45.9 (39)		23.2 (23)	44.4 (40)	
Never	2.2 (2)	4.4 (4)	2.0 (2)	3.3 (3)	4.5 (4)	8.2 (7)		0.0 (0)	5.6 (5)	
Do you usually have Snacks							0.929			0.273
Yes	92.1 (82)	91.8 (78)	96 (95)	92.2 (83)	92.1 (82)	91.8 (78)		96 (95)	92.2 (83)	
No	7.9 (7)	8.2 (7)	4.0 (4)	7.8 (7)	7.9 (7)	8.2 (7)		4.0 (4)	7.8 (7)	
How many snacks per day							0.184			0.104
One or Two	68.9 (62)	73.6 (64)	43.9 (43)	41.1 (37)	72.1 (62)	62.3 (48)		82.8 (82)	73.0 (65)	
Three or more	31.1 (28)	26.4 (23)	56.1 (55)	58.9 (53)	27.9 (24)	37.7 (29)		17.2 (17)	27.0 (24)	
Do you buy food from your school shop							0.069			< 0.001
Yes	94.6 (87)	96.7 (87)	66.3 (67)	87.9 (80)	87.6 (78)	95.3 (82)		57.6 (57)	93.3 (84)	
No	5.4 (5)	3.3 (3)	33.7 (34)	12.1 (11)	12.4 (11)	4.7 (4)		42.4 (42)	6.7 (12.5)	
Do you get food from home to school							0.004			0.007
Yes	90.2 (83)	65.6 (59)	88.1 (89)	81.3 (74)	85.2 (75)	66.7 (56)		87.8 (86)	72.2 (65)	
No	9.8 (9)	34.4 (31)	11.9 (12)	18.7 (17)	14.8 (13)	33.3 (28)		12.2 (12)	27.8 (25)	
Do youeat while watching tv							0.053			0.035
All the time	22.8 (21)	12.2 (11)	13.9 (14)	16.5 (15)	12.4 (11)	11.8 (10)		7.1 (7)	20.0 (18)	
Sometimes	46.7 (43)	65.6 (59)	72.3 (73)	75.8 (69)	57.3 (51)	72.9 (62)		74.7 (74)	66.7 (60)	
No	30.4 (28)	22.2 (20)	13.9 (14)	7.7 (7)	30.3 (27)	15.3 (13)		18.2 (18)	12.2 (11)	
How many times do you eat out per week							0.652			0.264
Three or more	22.5 (20)	17.8 (16)	9.9 (10)	17.6 (16)	20.5 (18)	23.8 (20)		8.1 (8)	15.6 (14)	
Once or twice	46.1 (41)	37.8 (34)	77.2 (78)	71.4 (65)	42.0 (37)	45.2 (38)		80.8 (80)	75.6 (68)	
Never	31.5 (28)	44.4 (40)	12.9 (13)	11.0 (10)	37.5 (33)	31.0 (26)		11.1 (11)	8.9 (8)	

p value significant at $p < 0.05$. Values derived from Chi square tests for all the variables without considering clustering

Table 5.3.2: Frequencies of students' behaviours Pre and Post intervention / Dietary habits by gender

Dietary Habits	Baseline				Post Intervention					
	Male		Female		Male			Female		
	Intervention (n=111)	Control (n=93)	Intervention (n=82)	Control (n=88)	Intervention (n=111)	Control (n=93)	*P value*	Intervention (n=82)	Control (n=88)	*P value*
	%(n)		%(n)		%(n)			%(n)		
Do you usually have Breakfast							< 0.001			0.006
Everyday	77.3 (85)	61.3 (57)	63.4 (52)	64.8 (57)	80.2 (85)	46.6 (41)		71.6 (58)	49.4 (43)	
Sometimes	20.9 (23)	36.6 (34)	34.1 (280	29.5 (26)	17.0 (18)	47.7 (43)		27.2 (22)	42.5 (37)	
Never	1.8 (2)	2.2 (2)	2.4 (2)	5.7 (5)	2.8 (3)	5.7 (5)		1.2 (1)	8.0 (7)	
Do you usually have Snacks							0.726			0.464
Yes	94.4 (101)	93.2 (82)	93.8 (76)	90.8 (79)	94.4 (101)	93.2 (82)		93.8 (76)	90.8 (79)	
No	5.6 (6)	6.8 (6)	6.2 (5)	9.2 (8)	5.6 (6)	6.8 (6)		6.2 (5)	9.2 (8)	
How many snacks per day							0.041			0.361
One or Two	53.3 (57)	48.9 (45)	59.3 (48)	65.9 (56)	77.4 (82)	63.9 (53)		78.5 (62)	72.3 (60)	
Three or more	46.7 (50)	51.1 (47)	40.7 (33)	34.1 (29)	22.6 (24)	36.1 (30)		21.5 (17)	27.7 (23)	
Do you buy food from your school shop							< 0.001			< 0.001
Yes	78.4 (87)	92.5 (86)	81.7 (67)	92.0 (81)	74.8 (80)	95.5 (85)		67.9 (55)	93.1 (81)	
No	21.6 (24)	7.5 (7)	18.3 (15)	8.0(7)	25.2 (27)	4.5 (4)		32.1 (26)	6.9 (6)	
Do you get food from home to school							0.001			0.022
Yes	86.5 (96)	73.1 (68)	92.7 (76)	73.9 (65)	85.8 (91)	65.9 (58)		87.5 (70)	73.3 (63)	
No	13.5 (15)	26.9 (25)	7.3 (6)	26.1 (23)	14.2 (15)	34.1 (30)		12.5 (10)	26.7 (23)	
Do youeat while watching tv							0.17			0.455
All the time	18.9 (21)	20.4 (19)	17.1 (14)	8.0 (7)	12.1 (13)	21.6 (19)		6.2 (5)	10.3 (9)	
Sometimes	56.8 (63)	73.1 (68)	64.6 (53)	68.2 (60)	63.6 (68)	68.2 (60)		70.4 (57)	71.3 (62)	
No	6.5 (6)	24.3 (27)	18.3 (15)	23.9 (21)	24.3 (26)	10.2 (9)		23.5 (19)	17.2 (15)	
How many times do you eat out per week							0.315			0.384
Three or more	19.4 (21)	24.7 (23)	11.0 (9)	10.2 (9)	16.8 (18)	25.3 (22)		10.0 (8)	13.8 (12)	
Once or twice	59.3 (64)	52.7 (49)	67.1 (55)	56.8 (50)	57.9 (62)	49.4 (43)		68.8 (55)	72.4 (63)	
Never	21.3 (23)	22.6 (21)	22.0 (18)	33.0 (29)	25.2 (27)	25.3 (22)		21.2 (17)	13.8 (12)	

p value significant at $p < 0.05$. Values derived from Chi square tests for all the variables without considering clustering

Table 5.5.1: Types of snacks consumed between meals in intervention and control groups by school type

What do you have for snacks	Baseline				Post Intervention					
	Public		Private		Public			Private		
	Intervention (n=92)	Control (n=93)	Intervention (n=100)	Control (n=89)	Intervention (n=92)	Control (n=93)	P value	Intervention (n=100)	Control (n=89)	P value
	%(n)		%(n)		%(n)			%(n)		
Chips	47.8 (44)	50.0 (45)	32.7 (33)	33.0 (30)	13.5 (12)	47.1 (40)	< 0.001	10.1 (10)	33.3 (30)	< 0.001
Soft drinks	32.6 (30)	46.7 (42)	19.8 (20)	33.0 (30)	5.6 (5)	31.8 (27)	< 0.001	11.1 (11)	21.1 (19)	0.06
Chocolate	44.0 (40)	43.3 (39)	53.5 (54)	60.4 (55)	11.2 (10)	31.4 (27)	0.001	42.4 (42)	41.1 (37)	0.855
Sweetened drinks	71.7 (66)	51.1 (46)	57.4 (58)	46.2 (42)	24.7 (22)	41.2 (35)	0.021	60.6 (60)	46.7 (42)	0.055
Fruits	76.1 (70)	57.8 (52)	73.3 (74)	67.0 (61)	61.8 (55)	44.2 (38)	0.2	77.8 (77)	66.7 (60)	0.088
Sandwich	55.4 (51)	43.3 (39)	25.7 (26)	37.4 (34)	55.1 (49)	29.4 (25)	0.001	26.3 (26)	35.6 (32)	0.167

p value significant at p < 0.05. Values derived from Chi square tests for all the variables without considering clustering

Table 5.5.2: Types of snacks consumed between meals in intervention and control groups by gender

What do you have for snacks	Baseline				Post Intervention					
	Male		Female		Male			Female		
	Intervention (n=111)	Control (n=93)	Intervention (n=82)	Control (n=88)	Intervention (n=111)	Control (n=93)	P value	Intervention (n=82)	Control (n=88)	P value
	%(n)		%(n)		%(n)			%(n)		
Chips	40.5 (45)	47.3 (44)	39.0 (32)	35.2 (31)	12.1 (13)	44.9 (40)	< 0.001	11.1 (9)	34.9 (30)	< 0.001
Soft drinks	28.8 (32)	47.3 (44)	22.0 (18)	31.8 (28)	8.4 (9)	28.1 (25)	< 0.001	8.6 (7)	24.4 (21)	0.06
Chocolate	49.1 (54)	55.9 (52)	48.8 (40)	47.7 (42)	25.2 (27)	36.0 (32)	0.103	30.9 (25)	36.8 (32)	0.418
Sweetened drinks	60.4 (67)	51.6 (48)	69.5 (57)	45.5 (40)	39.3 (42)	46.1 (41)	0.336	49.4 (40)	41.9 (36)	0.329
Fruits	76.6 (85)	59.1 (55)	72.0 (59)	65.9 (58)	62.6 (67)	50.6 (54)	0.09	80.2 (65)	60.9 (53)	0.006
Sandwich	43.2 (48)	44.1 (41)	35.4 (29)	36.4 (32)	38.3 (41)	33.7 (30)	0.504	42.0 (34)	31.4 (27)	0.156

p value significant at p < 0.05. Values derived from Chi square tests for all the variables without considering clustering

Table 5.7.1: Frequency of food purchased from school shop in intervention and control groups by school type

	Baseline				Post Intervention					
	Public		Private		Public			Private		
What do you buy from the school shop	Intervention (n=92)	Control (n=93)	Intervention (n=100)	Control (n=89)	Intervention (n=92)	Control (n=93)	*P value*	Intervention (n=100)	Control (n=89)	*P* value*
	% (n)		% (n)		% (n)			% (n)		
Chips	49.5 (45)	57.8 (52)	2.0 (2)	2.2 (2)	15.7 (14)	58.1 (50)	< 0.001	1.0 (1)	2.2 (2)	0.505
Soft drinks	36.3 (33)	44.4 (40)	2.0 (2)	4.4 (4)	5.6 (5)	36.0 (31)	< 0.001	2.0 (2)	4.4 (4)	0.342
Chocolate or Biscuits	46.2 (42)	46.7 (42)	34.0 (34)	49.5 (45)	15.7 (14)	41.9 (36)	0.003	22.2 (22)	42.2 (38)	0.003
Sweet drinks	54.9 (50)	36.7 (33)	47.0 (47)	61.5 (56)	27.0 (24)	41.9 (36)	0.038	43.4 (43)	63.3 (57)	0.006
Croissant	59.3 (54)	28.9 (26)	12.0 (12)	13.2 (2)	27.0 (24)	30.2 (260	0.033	11.1 (11)	13.3 (2)	0.641
Manouche	56.0 (51)	52.2 (47)	33.0 (33)	52.7 (48)	43.8 (39)	33.7 (29)	0.171	29.3 (29)	48.9 (44)	0.006

p value significant at p < 0.05. Values derived from Chi square tests for all the variables without considering clustering

Table 5.7.2: Frequency of food purchased from school shop in intervention and control groups by gender

	Baseline				Post Intervention					
	Male		Female		Male			Female		
What do you buy from the school shop	Intervention (n=111)	Control (n=93)	Intervention (n=82)	Control (n=88)	Intervention (n=111)	Control (n=93)	*P value*	(n=82)	Control (n=88)	*P value*
	%(n)		%(n)		%(n)			%(n)		
Chips	27.3 (30)	30.1 (28)	21.0 (17)	29.5 (26)	10.3 (11)	27.0 (24)	0.002	4.9 (4)	32.2 (28)	< 0.001
Soft drinks	22.7 (25)	29.0 (27)	12.3 (10)	19.3 (17)	2.8 (3)	24.7 (22)	< 0.001	4.9 (4)	14.9 (13)	0.032
Chocolate or Biscuits	39.1 (43)	49.5 (46)	40.7 (33)	46.6 (41)	17.8 (19)	40.4 (36)	< 0.001	21.0 (17)	43.7 (38)	0.002
Sweet drinks	47.3 (52)	50.5 (47)	55.6 (45)	47.7 (42)	33.6 (36)	53.9 (48)	0.004	38.3 (31)	51.7 (45)	0.08
Croissant	39.1 (43)	25.8 (24)	28.4 (23)	15.9 (14)	18.7 (20)	23.6 (21)	0.401	18.5 (15)	19.5 (17)	0.866
Manouche	49.1 (54)	53.8 (50)	37.0 (30)	51.1 (45)	37.4 (40)	43.8 (49)	0.36	34.6 (28)	39.1 (34)	0.545

p value significant at p < 0.05. Values derived from Chi square tests for all the variables without considering clustering

Table 5.9.1: Frequencies of students' behaviours pre and post intervention/ physical activity habits by school type

Exercise Habits	Baseline				Post Intervention					
	Public		Private		Public			Private		
	Intervention (n=92)	Control (n=93)	Intervention (n=100)	Control (n=89)	Intervention (n=92)	Control (n=93)	*P value*	Intervention (n=100)	Control (n=89)	*P value*
	% (n)		% (n)		% (n)			% (n)		
Do you play at recess							0.317			0.274
Yes	76.1 (70)	80.0 (72)	90.1 (91)	81.3 (74)	88.8 (79)	83.5 (71)		87.9 (87)	82.2 (74)	
No	23.9 (22)	20.0 (18)	9.9 (10)	18.7 (17)	11.2 (10)	16.5 (14)		12.1 (12)	17.8 (16)	
Do you play at home after school							0.002			0.566
Yes	21.7 (20)	32.2 (29)	40.6 (41)	28.6 (26)	51.1 (45)	44.7 (38)		44.9 (44)	38.9 (35)	
Sometimes	27.2 (25)	33.3 (30)	33.7 (34)	30.8 (28)	13.6 (12)	35.3 (30)		27.6 (27)	26.7 (24)	
No	51.1 (47)	34.4 (31)	25.7 (26)	40.7 (37)	35.2 (31)	20.0 (17)		27.6 (27)	34.4 (31)	
How many times you do sports after school or during weekend							0.59			0.005
Three or more	32.6 (30)	30.0 (27)	45.0 (45)	51.6 (47)	48.3 (43)	55.3 (47)		74.5 (73)	56.2 (50)	
Once or twice	48.9 (450	53.3 (48)	44.0 (44)	42.9 (39)	41.6 (37)	34.1 (29)		23.5 (23)	31.5 (28)	
I don't	18.5 (17)	16.7 (15)	11.0 (11)	5.5 (5)	9.1 (9)	10.6 (9)		2.0 (2)	12.4 (11)	

p value significant at $p < 0.05$. Values derived from Chi square tests for all the variables without considering clustering

Table 5.9.2: Frequencies of students' behaviours pre and post intervention/ physical activity habits by gender

Exercise Habits	Baseline				Post Intervention					
	Male		Female		Male			Female		
	Intervention (n=111)	Control (n=93)	Intervention (n=82)	Control (n=88)	Intervention (n=111)	Control (n=93)	*P value*	Intervention (n=82)	Control (n=88)	*P value*
	% (n)		% (n)		% (n)			% (n)		
Do you play at recess							0.112			0.648
Yes	84.7 (94)	81.7(76)	81.7 (67)	79.5 (70)	89.7 (86)	81.8 (72)		86.4 (70)	83.9 (73)	
No	15.3 (17)	18.3 (17)	18.3 (15)	20.5 (18)	10.3 (11)	18.2 (16)		13.6 (11)	16.1 (14)	
Do you play at home after school							0.388			0.342
Yes	34.2 (38)	35.5 (33)	28.0 (23)	25.0 (22)	50.0 (53)	45.5 (40)		45.0 (36)	37.9 (33)	
Sometimes	27.0 (30)	30.1 (28)	35.4 (29)	34.1 (30)	17.0 (18)	25.0 (22)		26.2 (21)	36.8 (32)	
No	38.7 (43)	34.4 (32)	36.6 (30)	40.9 (36)	33.0 (35)	29.5 (26)		28.7 (23)	25.3 (22)	
How many times you do sports after school or during weekend							0.617			0.089
Three or more	47.3 (52)	44.1 (41)	28.0 (23)	37.5 (33)	62.6 (67)	60.9 (53)		61.3 (49)	50.6 (44)	
Once or twice	42.7 (47)	41.9 (39)	51.2 (42)	54.5 (48)	29.0 (31)	26.4 (23)		36.2 (29)	39.1 (34)	
I don't	10.0 (11)	14.0 (13)	20.7 (17)	8.0 (7)	8.4 (9)	12.6 (11)		2.5 (2)	10.3 (9)	

p value significant at p < 0.05. Values derived from Chi square tests for all the variables without considering clustering

Table 5.11.1: Frequencies of students' behaviours pre and post intervention/ screen time habits by school type

Screen time	Baseline				Post Intervention					
	Public		Private		Public			Private		
	Intervention (n=92)	Control (n=93)	Intervention (n=100)	Control (n=89)	Intervention (n=92)	Control (n=93)	*P value*	Intervention (n=100)	Control (n=89)	*P value*
	%(n)		%(n)		%(n)			%(n)		
Do you watch TV during week days							0.128			0.169
a lot	27.5 (25)	21.7 (18)	34.7 (35)	36.3 (33)	29.1 (23)	23.8 (20)		30.9 (30)	40.2 (35)	
a little	39.6 (36)	62.7 (52)	60.4 (61)	57.1 (52)	44.3 (35)	59.5 (50)		61.9 (60)	48.3 (42)	
I don't	33.0 (30)	15.7 (13)	5.0 (5)	6.6 (6)	26.6 (21)	16.7 (14)		7.2 (7)	11.5 (10)	
Do you watch TV during weekends							0.143			0.55
all day	27.2 (25)	18.9 (17)	30.7 (31)	38.9 (35)	25.8 (23)	28.2 (24)		28.3 (28)	29.2 (26)	
twice a day	22.8 (21)	42.2 (38)	30.7 (31)	36.7 (33)	16.9 (15)	23.5 (20)		34.3 (34)	38.2 (34)	
once a day	40.2 (37)	33.3 (30)	35.6 (36)	24.4 (22)	42.7 (38)	43.5 (37)		35.4 (35)	32.6 (29)	
I don’t	9.8 (9)	5.6 (5)	3.0 (3)	0.0 (0)	14.6 (13)	4.7 (4)		2.0 (2)	0.0 (0)	
Do you play electronic games after school							0.176			0.69
Every day for a long time	17.4 (16)	14.4 (13)	18.8 (19)	24.2 (22)	15.9 (14)	8.4 (7)		16.5 (16)	23.5 (20)	
Every day for a short time	44.6 (41)	43.3 (39)	37.6 (38)	37.4 (34)	51.1 (45)	43.4 (36)		39.2 (38)	36.5 (31)	
3 or more times a week	22.8 (21)	16.7 (15)	25.7 (26)	25.3 (23)	14.8 (13)	21.7 (18)		23.7 (23)	22.4 (19)	
I don’t	15.2 (14)	25.6 (23)	17.8 (18)	13.2 (12)	18.2 (16)	26.5 (22)		20.6 (20)	17.6 (15)	
Do you play electronic games during weekends							0.468			0.748
All day	19.6 (18)	19.1 (17)	20.0 (20)	31.9 (29)	18.2 (16)	23.8 (20)		23.2 (23)	23.3 (21)	
twice a day	26.1 (24)	22.5 (20)	31.0 (31)	26.4 (24)	29.5 (26)	20.2 (17)		27.3 (27)	31.1 (28)	
once a day	34.8 (32)	38.2 (34)	44.0 (44)	37.4 (34)	31.8 (28)	31.0 (26)		41.4 (41)	41.1 (37)	
I don't	19.6 (18)	19.1 (17)	5.0 (5)	4.4 (4)	20.5 (18)	25 (21)		8.1 (8)	4.4 (4)	

p value significant at p < 0.05. Values derived from Chi square tests for all the variables without considering clustering

Table 5.11.2: Frequencies of students' behaviours pre and post intervention/ screen time habits by gender

Screen time	Baseline				Post Intervention					
	Male		Female		Male			Female		
	Intervention (n=111)	Control (n=93)	Intervention (n=82)	Control (n=88)	Intervention (n=111)	Control (n=93)	*P value*	Intervention (n=82)	Control (n=88)	*P value*
	%(n)		%(n)		%(n)			%(n)		
Do you watch TV during week days							0.38			0.523
a lot	32.4 (36)	39.8 (35)	29.6 (24)	18.6 (16)	34.3 (34)	44.0 (37)		24.7 (19)	20.7 (18)	
a little	48.6 (54)	50.0 (44)	53.1 (43)	69.8 (60)	53.5 (53)	44.0 (37)		54.5 (42)	63.2 (55)	
I don't	18.9 (21)	10.2 (9)	17.3 (14)	11.6 (10)	12.1 (12)	11.9 (10)		20.8 (16)	16.1 (14)	
Do you watch TV during weekends							0.119			0.081
all day	30.6 (34)	39.8 (37)	26.8 (22)	17.2 (15)	23.4 (25)	34.5 (30)		32.1 (26)	23.0 (20)	
twice a day	21.6 (24)	33.3 (31)	34.1 (28)	46.0 (40)	25.2 (27)	29.9 (26)		27.2 (22)	32.2 (28)	
once a day	41.4 (46)	22.6 (21)	32.9 (27)	35.6 (31)	43.0 (46)	32.2 (28)		33.3 (27)	43.7 (38)	
I don't	6.3 (7)	4.3 (4)	6.1 (5)	1.1 (1)	8.4 (9)	3.4 (3)		7.4 (6)	1.1 (1)	
Do you eat while watching TV?							0.017			0.455
All the time	18.9 (21)	20.4 (19)	17.1 (14)	8.0 (7)	12.1 (13)	21.6 (19)		6.2 (5)	10.3 (9)	
Sometimes	56.8 (53)	73.1 (68)	64.6 (53)	68.2 (60)	63.6 (68)	68.2 (60)		70.4 (57)	71.3 (62)	
No	24.3 (27)	6.5 (6)	18.3 (15)	23.9 (21)	24.3 (26)	10.2 (9)		23.5 (19)	17.2 (15)	
Do you play electronic games after school							0.218			0.858
Every day for a long time	24.3 (27)	26.9 (25)	9.8 (8)	11.4 (10)	20.6 (22)	20.5 (17)		10.3 (8)	11.8 (10)	
Every day for a short time	37.8 (42)	33.3 (31)	45.1 (37)	47.7 (42)	46.7 (50)	33.7 (28)		42.3 (33)	45.9 (39)	
3 or more times a week	25.2 (28)	23.7 (22)	23.2 (19)	18.2 (16)	20.6 (22)	25.3 (21)		17.9 (14)	18.8 (16)	
I don't	12.6 (14)	16.1 (15)	22.0 (18)	22.7 (20)	12.1 (13)	20.5 (17)		29.5 (23)	23.5 (20)	
Do you play electronic games during weekends							0.685			0.902
All day	28.2 (31)	35.9 (33)	8.5 (7)	14.8 (13)	21.5 (23)	26.1 (23)		20.0 (16)	20.9 (18)	
twice a day	29.1 (32)	27.2 (25)	28.0 (23)	21.6 (19)	32.7 (35)	30.7 (27)		22.5 (18)	20.9 (18)	
once a day	35.5 (39)	28.3 (26)	45.1 (37)	47.7 (42)	35.5 (38)	29.5 (26)		38.8 (31)	43.0 (37)	
I don't	7.3 (8)	7.6 (7)	18.3 (15)	15.9 (14)	10.3 (11)	13.6 (12)		18.8 (15)	15.1 (13)	

p value significant at $p < 0.05$. Values derived from Chi square tests for all the variables without considering clustering

Table 5.13.1: Knowledge and self-efficacy scores at baseline and post intervention in intervention and control groups/ by school type

Determinant	Mean ± SD at Baseline				Mean ± SD Post Intervention					
	Public		Private		Public			Private		
	Intervention (n=92)	Control (n=93)	Intervention (n=100)	Control (n=89)	Intervention (n=92)	Control (n=93)	*P value*	Intervention (n=100)	Control (n=89)	*P value*
	%(n)		%(n)		%(n)			%(n)		
Knowledge score ł	7.4 ± 2.7	8.6 ± 3.0	9.7 ± 3.0	9.2 ± 2.6	10.9 ± 3.0	7.6 ± 2.2	< 0.001	11.9 ± 2.9	9.3 ± 3.1	< 0.001
Self-efficacy score‡	14.6 ± 2.6	13.4 ± 2.7	14.2 ± 2.7	14.3 ± 2.8	16.5 ± 2.4	13.5 ± 3.2	< 0.001	15.6 ± 2.6	13.7 ± 3.5	< 0.001

p value significant at $p < 0.05$. Values derived from Chi square tests for all the variables without considering clustering

ł the sum of correct answers (correct = 1, incorrect, don't know = 0)‡ the sum of answers (not sure = 0, little sure = 1, very sure = 2)

Table 5.13.2: Knowledge and self-efficacy scores at baseline and post intervention in intervention and control groups/ by gender

Determinant	Mean ± SD at Baseline				Mean ± SD Post Intervention					
	Male		Female		Male			Female		
	Intervention (n=92)	Control (n=93)	Intervention (n=100)	Control (n=89)	Intervention (n=92)	Control (n=93)	*P value*	Intervention (n=100)	Control (n=89)	*P value*
	%(n)		%(n)		%(n)			%(n)		
Knowledge score ł	8.8 ± 3.0	8.5 ± 7.9	8.2 ± 3.0	9.3 ± 2.6	11.2 ± 2.8	7.9 ± 2.9	< 0.001	11.9 ± 3.1	9.1 ± 2.7	< 0.001
Self-efficacy score‡	14.3 ± 2.6	13.4 ± 2.8	14.5 ± 2.7	14.5 ± 2.6	14.9 ± 2.6	13.0 ± 3.6	< 0.001	16.1 ± 2.6	14.2 ± 3.0	< 0.001

p value significant at $p < 0.05$. Values derived from Chi square tests for all the variables without considering clustering

ł the sum of correct answers (correct = 1, incorrect, don't know = 0)‡ the sum of answers (not sure = 0, little sure = 1, very sure = 2)